# Baffinland Iron Mines Corporation

## Fresh Water Supply, Sewage, and Wastewater Management Plan

## BAF-PH1-830-P16-0010

## Rev 7

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**Index of Major Changes/Modifications in Revision 7**

| Item No. | Description of Change | Relevant Section |
|---|---|---|
| 1 | Reorganized sections for consistency with other management plans | NA |
| 2 | Added information about water truck water withdrawals | 5.1.14 |
| 2 | Included updated information for accommodations and sewage treatment plants | 5.3.1, 6.4.1, 6.4.2 |
| 4 | Updated information for management of oily water | 7.2.2 |
| 5 | Addition of Waste Rock Facility Water Treatment Plant information | 7.7 |
| 6 | Added additional information regarding contingency measures | 10 |
| 7 | Updated appendices for site layout diagrams, and PWSP Treatment and Discharge Plan | Appendices |

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***Appendix F - Steensby and Rail Camps Freshwater Supply, Sewage and Wastewater – Plans for Future Work***

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***Appendix J – BAF-PHl-340-PRO-048 – Waste Pond Water Treatment Plant Operations***

***Appendix K – BAF-PH1-830-P16-0047– Metal and Diamond Mining Effluent Regulations Emergency Response Plan***

***Appendix L - Oily Water Treatment and Discharge Plan***

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# 1 INTRODUCTION

This document describes the plan to manage the fresh water supply and wastewater for the various camp sites for the Mary River Project during the Project's construction and operation phases. Specifically, this document focuses on freshwater supply and wastewater treatment and disposal at Milne Port, the Mine Site, Steensby Port, and various temporary camps.

The Fresh Water Supply, Sewage, and Wastewater Management Plan is an update to the existing plan and supersedes the BAF-PH1-830-P16-0010, Revision 6, dated March 2019. This Plan will continue to support the Membrane Biological Reactor (MBR) sewage treatment plants (STPs) installed in 2014 which service the Mine Site Complex (MSC) and Port Site Complex (PSC) camps, the MBR sewage treatment plant installed in 2018 to service the Sailiivik Camp, the MBR sewage treatment plant installed in 2019 to service the 380 Person Camp and the potable water supply and oily water treatment activities under the Type A Water Licence 2AM-MRY1325 – Amendment No. 1 (Type A Water Licence). This Plan will also support future upgrades and additions to the MBR STPs necessary to service future MSC, PSC and Sailiivik camp expansions at the Mine Site and Milne Port.

This Plan should be used in conjunction with the Aquatic Effects Monitoring Plan (AEMP)[1] (BAF-PH1-830-P16-0039) and the Sampling Program – Quality Assurance and Quality Control (QA/QC) Plan[2] (BAF-PH1-830-P16-0001).

# 2 REGULATIONS, STANDARDS, AND CODES

This Plan has been developed under the requirements of Baffinland's Type A Water Licence (refer to the concordance table for the Type A Water Licence presented in Appendix B). Furthermore, all actions undertaken under this Plan will be compliant with the appropriate sections of both Federal and Territorial legislation as indicated in Table 2-1.

**TABLE 2-1: APPLICABLE REGULATIONS, STANDARDS, AND CODES**

| TITLE | NUMBER/ACRONYM |
|---|---|
| American Water Works Association | AWWA |
| International Building Codes | IBC |
| National Sanitation Foundation | NSF |
| Health Canada Guidelines for Canadian Drinking Water Quality | GCDWQ |
| Northwest Territories Water Supply System Regulations | NWT Regulation 108-2009 |
| *Safe Drinking Water Act, 2002* | Ontario Regulation 170/03 |
| *Nunavut Waters and Nunavut Surface Rights Tribunal Act, SC2 002, c. 10* | -- |
| *Northwest Territories Water Act* | NWTWA |
| Northwest Territories Water Regulations (SOR/93-303) | -- |
| Ontario Drinking Water Quality Standards | -- |

[1] Baffinland Iron Mines Corporation. Mary River Project – Aquatic Effects Monitoring Plan, Rev. 1. March 2016.
[2] Baffinland Iron Mines Corporation, Mary River Project - Sampling Program – Quality Assurance and Quality Control (QA/QC) Rev. 2, March 2017.

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| TITLE | NUMBER/ACRONYM |
|---|---|
| Federal *Fisheries Act* | -- |
| *Canadian Environmental Protection Act (1999)* | CEPA |
| CCME Water Quality Guidelines for the Protection of Aquatic Life | -- |
| Ontario Guidelines for Sewage Works, 2008 | -- |
| Drinking Water System Components | NSF/ANSI Standard 61 |
| Filtering Material | AWWA Standard B100 |
| Granular Activated Carbon | AWWA Standard B604 |
| Canada Occupational Health and Safety Regulations | OSH |
| Metal and Diamond Mining Effluent Regulations | MDMER |

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# 3 CORPORATE POLICIES

Baffinland's Sustainable Development Policy identifies Baffinland's commitment internally and to the public to operate in a manner that is environmentally responsible, safe, fiscally responsible and respectful of the cultural values and legal rights of Inuit. The Sustainable Development Policy is provided in Appendix A.

Baffinland's Health, Safety and Environment Policy is the company's commitment to achieve a safe, health and environmentally responsible workplace. The policy is provided in Appendix A.

All employees and contractors are expected to comply with the contents of both above mentioned policies.

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# 4 ENVIRONMENTAL RESPONSIBILITIES

## 4.1 ROLES AND RESPONSIBILITIES

Responsibilities for the management and monitoring of surface water flows, potable water systems and effluents at the Project are as follows:

### 4.1.1 CHIEF OPERATIONS OFFICER (COO)/GENERAL MANAGER

- Reports to the Chief Executive Officer
- Responsible for providing oversight for all Project operations and allocating the necessary resources for the operation, maintenance and management of Project infrastructure.

### 4.1.2 MINE OPERATIONS MANAGER/SUPERINTENDENT

- Reports to the COO/General Manager
- Provides oversight for all Deposit No. 1 mining operations, including the operation, construction and maintenance of water and waste management infrastructure at Deposit No. 1 mining areas, ROM stockpile, Waste Rock Facility and along the Mine Haul Road, including culverts, ditches, surface water management ponds and associated water treatment systems.

### 4.1.3 CRUSHING MANAGER/SUPERINTENDENT

- Reports to the COO/General Manager
- Provides oversight for all ore crushing operations, including the operation, construction and maintenance of surface water management infrastructure at the Mine Site Crusher Facility, including culverts, ditches, surface water management ponds and any associated water treatment systems.

### 4.1.4 SITE SERVICES MANAGER/SUPERINTENDENT

- Reports to the COO/General Manager
- Provides oversight for all Site Services operations, including the operation, construction and maintenance of water and waste management infrastructure and treatment systems at the Mine Site and Milne Port.
- Responsible for managing water retained in containment areas associated with Project bulk fuel facilities and hazardous materials/waste storage areas, including landfarm facilities.

### 4.1.5 ROAD MAINTENANCE MANAGER/SUPERINTENDENT

- Reports to the COO/General Manager
- Provides oversight for all Road Maintenance operations, including the operation, construction and maintenance of surface water management infrastructure for the Tote Road that runs between Milne Port and the Mine Site, including culverts, bridges, ditches and swales.

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### 4.1.6 Environment (Sustainable Development) Department

- Support the management of the Project's surface water management infrastructure by advising operational departments and obtaining the appropriate regulatory approvals for necessary changes and modifications.
- Advise operational departments on the implementation of the appropriate controls to manage surface water flows and effluents at the Project, including the implementation of sedimentation and erosion controls.
- Report incidents to senior management and the appropriate regulatory agencies and stakeholders.
- Conduct inspections and monitoring to ensure compliance with applicable regulations and commitments.
- Provide training sessions to operational departments on the appropriate mitigation measures and strategies for managing surface water flows and effluents at the Project.

### 4.1.7 All Departmental Supervisors

- Reports to the Departmental Manager/Superintendent
- Responsible for reading and understanding applicable sections of this Plan and directing departmental personnel on the appropriate mitigation measures and strategies for managing surface water flows and effluents in their Project area.

### 4.1.8 All Project Personnel

All personnel Project personnel are responsible for complying with the requirements of this Plan in the management of surface water flows and effluents at the Project.

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# 5 FRESH WATER

## 5.1 GENERAL MITIGATION MEASURES FOR WATER USE

### 5.1.1 WATER INTAKES

#### 5.1.1.1 ENGINEERING INTAKE STRUCTURES

Engineered intake structures are designed to minimize erosion, avoid sediment issues, and provide protection from ice and peak water flows. Care is taken to ensure that disturbance to aquatic environments is minimized during installation and maintenance of infrastructure. Riprap used in construction is clean, free of fine sediment, non-acid leaching, and non-metal generating.

#### 5.1.1.2 SCREENS ON INTAKE PIPES

Intakes are screened in accordance with the Fisheries and Oceans Canada (DFO) Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO Guideline, 1995) to ensure no entrainment or impingement of fish. The guideline also requires a water withdrawal rate such that fish do not become impinged on the screen.

#### 5.1.1.3 SELECTION OF SHORT-TERM WATER TAKE LOCATIONS

Short-term water intake will be required at several locations for a variety of needs including concrete production, drilling, and dust suppression, etc. In accordance with the Type 'A' Water Licence for the project, streams or water bodies may not be used as a water source unless authorized and approved by the NWB in writing. A screening process is used to confirm whether water sources are considered adequate as water take locations. Source selection begins by looking for the largest possible water body that is feasible for use. Lakes are considered first, followed by ponds and then large rivers. Streams and creeks will not be used for short-term water withdrawal without prior approval of the Water Licence Inspector. The DFO guideline used for sourcing water from water bodies is to restrict removal of water to a maximum of 5% of the total volume. During winter under ice conditions, water must be drawn from below two metres (2 m) of non-frozen water (as the top two metres (2 m) of water provides higher oxygenation for resident fish). During the open-water season, the water taking guideline states that no significant drawdown shall be caused. There must be no impact to fish or fish habitat. Any water intake locations not identified the below Table 5-1 and Table 5-2 must be approved by the Environment Department prior to use.

#### 5.1.1.4 WATER TRUCK WATER WITHDRAWALS

Water trucks withdraw water from Km 32 Lake to supply Milne Port, and from Camp Lake to supply the Mine Site for domestic and industrial water needs. A number of water sources are relied upon for use in dust control. Intakes on the extraction hoses are screened in accordance with the DFO guideline. Water withdrawals are short-term (approximately 20 minutes to fill a water truck) and the approved and proposed water withdrawals are based on guidance established by Knight Piésold (2014).

#### 5.1.1.5 WATER USAGE AND CONSERVATION MEASURES

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Water meters are installed at strategic locations to monitor water consumption and enable the development of management strategies to reduce water usage/consumption. These strategies include the installation of low flow water taps. If water meters aren't available, water use will be estimated using flow rates.

Water withdrawn from approved water intake locations within the Project is recorded and reported to the Environment Department. All personnel involved with water use activities are to follow the Type A Water Licence to ensure that daily withdrawal limits are not exceeded. Controls that may be implemented to ensure daily limits are not exceeded include water meters, source location and limit signage, ongoing training of involved personnel in water taking, detailed water truck logs and effective communication between day shift and night shift operators.

## 5.2 FRESH WATER SOURCES

All fresh water for domestic camp use and industrial purposes, during Construction and Operation Phases of the Project shall be obtained in amount and from sources listed in Table 5-1. Domestic water use is for camp operations, and industrial uses are primarily for firewater and other industrial uses (e.g. concrete production).

**TABLE 5-1: WATER USE FOR DOMESTIC AND INDUSTRIAL PURPOSES DURING THE CONSTRUCTION AND OPERATION PHASES***

| Site | Source | Construction Phase | Operation Phase | | |
|---|---|---|---|---|---|
| | | Volume ($m^3$/day) | Domestic | Industrial | Combined |
| | | | Volume ($m^3$/day) | | |
| Milne Port (Milne Inlet) | Phillips Creek (summer)<br>Km 32 Lake (Winter) | 367.5 | 300 | 67.5 | 367.5 |
| Mine Site (Mary River) | Camp Lake | 657.5 | 203.8 | 151.6 | 355.4 |
| Steensby Port (Steensby Inlet) | ST 347 Km Lake<br>3 Km Lake | 435.8 | 101 | 142.6 | 243.6 |
| Raven River | Camp Lake | 145.2 | N/A | N/A | N/A |
| Mid-Rail | Nivek Lake (Summer)<br>Ravn Camp Lake (Winter) | 79.5 | N/A | N/A | N/A |

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| | | | | | |
|---|---|---|---|---|---|
| Cockburn North (Tunnels Camp) | Cockburn Lake | 101.4 | N/A | N/A | N/A |
| Cockburn South Camp | Cockburn Lake | 111.1 | N/A | N/A | N/A |
| **TOTAL** | | **1,898** | **604.8** | **361.7** | **966.5** |

*Source: Type A Water Licence (2AM-MRY1325 – Amendment No. 1).

Table 5-2 outlines approved water sources under the Type A Water Licence for dust suppression. Table 5-2 includes approved water sources which are smaller streams. Water can be extracted from these streams during June and July in any year, with the exception of dry years where water withdrawals are prohibited during August and September. The Environment Department will be consulted before withdrawing water from these streams listed in Table 5-2 to verify if it is a wet or dry year and if water withdrawals are authorized.

**TABLE 5-2: WATER USE LOCATIONS AUTHORIZED FOR DUST SUPPRESSION***

| Site | Source | Proposed Maximum Volume (m3/day) | Restriction |
|---|---|---|---|
| Tote Road | Phillip's Creek | 212 | None |
| | Km 32 Lake | 364 | |
| | CV128 | 579.5 | |
| | CV099 | 110 | June – July only during low flow (less than mean flow) years |
| | CV087 | 90 | |
| | CV078 | 75 | |
| | Katiktok Lake | 318 | None |
| | BG50 | 150 | |
| | BG32 | 120 | June – July only during low flow (less than mean flow) years |
| | CV217 | 130 | None |
| | Muriel Lake | 212 | |
| | David Lake | 132 | June – July only during low flow (less than mean flow) years |
| | BG17 | 75 | |
| | CV233 (Tom River) | 135 | None |
| | Camp Lake | 86 | |

*Source: Type 'A' Water Licence (2AM-MRY1325 – Amendment No. 1)

The above water sources have been approved by the Nunavut Water Board (NWB) as freshwater sources for dust suppression. Authorization by the NWB in writing must be obtained prior to withdrawing water at the sources listed above for any purpose other than dust suppression. Streams will not be used as a water source unless authorized and approved by the NWB in writing. Additionally, no material shall be removed from below the Ordinary High Water Mark (HWM) of any water body unless authorized. For remote fresh water requirements such as dust suppression, tunnelling, and geotechnical and exploration drilling, some water may be drawn by truck from nearby lakes and ponds and used directly for these purposes if the source is pre-approved by Baffinland's Type A Water Licence or by application to the NWB.

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Sources that are restricted by low flow years will have a visual inspection completed by environmental personnel to determine if restrictions need to be put in place on a regular basis. Environment personnel will then perform instantaneous flow measurement by staff gauge monitoring if deemed necessary. The instantaneous flow estimate will be done by measuring the height of water on a staff gauge and applying it to rating curves of representative streams around the Project. This data will be compared to low flow indices from current monitoring locations for a representative stream in consultation with a hydrologist to determine if it is a low flow year. The Environment Department will inform operators of any restrictions.

Water used for the purposes of exploration drilling and domestic camp use at supporting satellite exploration camps will be withdrawn under the authorization of Baffinland's Exploration Type B Water Licence (Type B Water Licence; 2BE-MRY1421). Water withdrawn for domestic camp use at satellite exploration camps will be withdrawn from sources proximal to each camp. Total water use for all satellite exploration camps will not exceed 49 $m^3$ per day. Likewise, drill water will be withdrawn from water source(s) proximal to drilling targets and shall not exceed 250 $m^3$ per day. Therefore, the volume of water withdrawn for all purposes under the Type B Water Licence will not exceed 299 $m^3$ per day.

## 5.3 FRESH WATER SYSTEM PROCESS DESCRIPTION

The following sections describe the fresh water systems at the Project sites. Each site also includes a potable water treatment system which produces drinking water for the personnel at the site during construction and operation phases. These systems treat water to meet the Guidelines for Canadian Drinking Water Quality (Health Canada, 2017) as well as the Ontario Drinking Water Quality Standards (Government of Ontario, 2018a). Minimum process equipment requirements are based upon the Northwest Territories Water Supply System Regulations, NWT Regulation 108-2009, Ontario Design Guidelines for Drinking Water Systems 2008, Ontario Regulation 170/03 – Drinking Water Systems, the Procedure for Disinfection of Drinking Water in Ontario, as well as best management practices.

### 5.3.1 MILNE PORT

Currently on site at Milne Port there are three (3) camps that support operations and construction activities. These camps include the Port Weatherhaven (PWH) Camp, Port Site Complex (PSC) Camp and the 380-Person Camp. Each camp contains a Potable Water Treatment Plant (PWTP) within or near the camp as well as freshwater tanks to store raw water being delivered. The freshwater demand for construction and operation are shown on drawing 'Milne Inlet – Water Supply Balance Block Flow Diagram' in Appendix D of this Plan.

A raw water truck draws water from either Km 32 Lake (in winter/summer) or Phillips Creek (in summer) and delivers the water to a water storage tank near the camp. Water from this tank is used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank ensures that fire water is always available in the tank. The Milne Port camp layout, including the locations of potable water related infrastructure, is presented in Appendix C. The potable water treatment scheme consists of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water then

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undergoes a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use.

### 5.3.2 MINE SITE

Currently on site at the Mine Site there are three (3) camps that support construction, operations and site wide exploration activities. These camps include the Mine Site Weatherhaven (MWH) Camp, the Sailiivik Camp Complex, and the Mine Site Complex (MSC) Camp. Each camp contains a PWTP within or near the camp as well as freshwater tanks to store raw water being delivered. The freshwater demand for construction and operation are shown on the drawing 'Mine Site – Water Supply Balance Block Flow Diagram' in Appendix D of this Plan.

Fresh water supply for the Mine Site is obtained using an electric pump positioned inside a heated and insulated pump house on a raw water jetty on Camp Lake. Water is pumped directly from the lake source to water storage tanks located at both camps. Storage tanks that are not connected to this water line are filled from water trucks that draft water directly from the pump house. Water from these tanks will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within each tank ensures that fire water is always available in the tank. The Mine Site camp layout, including locations of potable water related infrastructure, is presented in Appendix C of this Plan.

The potable water treatment scheme consists of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use.

Some fresh water requirements such as road dust suppression, exploration drilling, quarry dust suppression, and concrete and explosives manufacturing will be provided directly from Camp Lake and other nearby lakes using water trucks. Exploration drilling will continue throughout the construction and operation phases of the Project.

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# 6 SEWAGE TREATMENT

## 6.1 SEWAGE GENERATION RATE

The estimated generation of sewage is based upon a per capita generation as shown in Table 6-1.

**TABLE 6-1: STP AVERAGE SEWAGE FLOW DESIGN BASIS**

| Parameter | Design Value | Source |
|---|---|---|
| Sewage Generation per Capita | 300 L/person/day | Design Basis – Sewage Treatment Plant, Doc. No. H337697-4000-10-109-0002 (FEIS, Appendix 3B). |

## 6.2 SEWAGE DISCHARGE CRITERIA

All sewage generated from relevant Project sites is directed to the Sewage Treatment Facilities or as otherwise approved by the NWB. As per the Type A Water Licence, Baffinland constructs and operates infrastructure and facilities designed to contain, withhold, divert, or retain Water and/or Waste in accordance with applicable legislation and industry standards. Effluent is discharged such that surface erosion is minimized and no additional impacts are created. Effluent discharge locations are regularly monitored for erosion and control measures are implemented as required. The quality of the sewage treatment plant effluent discharging to freshwater or directly into the ocean shall be in accordance with the applicable site discharge limits and the approved Type A Water Licence as listed in Table 6-2.

**TABLE 6-2: EFFLUENT DISCHARGE QUALITY LIMITS FOR SEWAGE TREATMENT FACILITIES TO FRESHWATER AND TO THE OCEAN***

| Parameter | Unit | Maximum Concentration of Any Grab Sample discharging into Freshwater (mg/L) | Maximum Concentration of any Grab Sample discharging into the Ocean (mg/L) |
|---|---|---|---|
| | | Monitoring Locations: MS-01, MS-01B, MS-01A, MS-MRY-04, MS-MRY-04A | Monitoring Locations: MP-01, MP-01A, SP-01, SP-01A, |
| $BOD_5$ | mg/L | 30 | 100 |
| TSS | mg/L | 35 | 120 |
| Faecal Coliform | CFU/100 mL | 1,000 CFU /100 ml | 10,000 CFU /100 ml |
| Oil and Grease* | mg/L | No visible sheen | No visible sheen |
| pH | --- | Between 6.0 and 9.5 | Between 6.0 and 9.5 |
| Ammonia (NH3-N) | mg/L | 4.0 | - |
| Total Phosphorus (MS-01, MS-01B, MS-MRY-04A) | mg/L | 4.0 | - |

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| Parameter | Unit | Maximum Concentration of Any Grab Sample discharging into Freshwater (mg/L) | Maximum Concentration of any Grab Sample discharging into the Ocean (mg/L) |
|---|---|---|---|
| | | Monitoring Locations: MS-01, MS-01B, MS-01A, MS-MRY-04, MS-MRY-04A | Monitoring Locations: MP-01, MP-01A, SP-01, SP-01A, |
| Total Phosphorus (MS-01A) | mg/L | 1.0 | - |
| Toxicity | --- | Final effluent not acutely toxic | Final effluent not acutely toxic |

*Source: Type A Water Licence (2AM-MRY1325 - Amendment No. 1) Table 4 and 5.

Locations MP-01 and MP-01A discharge directly into the ocean, therefore ocean discharge criteria apply.

Recycled water and use of reclaimed water from the various Treatment Facilities (STPs, OWSs, etc.), surface water management ponds, and embankment dams and approved discharge locations may be used if waters meet appropriate discharge criteria for those facilities. Sludge generated from Sewage Treatment Facilities or any other facilities shall be incinerated using the Milne Port and Mine Site on-site incinerators, or backhauled for disposal off site in Southern Canada.

## 6.3 TREATED WASTEWATER GENERATION AND DISCHARGE/OUTFALL LOCATIONS

Treated sewage and wastewater for the Project are discharged to the locations listed in Table 6-3:

**TABLE 6-3: TREATED EFFLUENT GENERATION AND DISCHARGE/OUTFALL LOCATIONS***

| Camp/Site | Discharge/Outfall Location | | Coordinates (UTM) |
|---|---|---|---|
| | Summer | Winter | |
| Milne Port | Ocean at Milne Inlet | | N: 7976338<br>E: 503636 |
| Mine Site | Sheardown Lake for Exploration Camp | Storage Ponds (PWSPs) | N: 7913630<br>E: 559733 |
| | Discharge 1 to Mary River | | N: 7911946<br>E: 562321 |
| | Discharge 2 to Mary River | | N: 7911938<br>E: 562342 |
| | Discharge 3 to Mary River | | N: 7912010<br>E: 562249 |

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| Camp/Site | Discharge/Outfall Location | | Coordinates (UTM) |
|---|---|---|---|
| | Summer | Winter | |
| Tote Road Work Sites | Conveyed to Mine Site or Milne Port Sewage Treatment Facilities | | N/A |
| Steensby (Port)** | Ocean at Steensby Inlet | | N: 7801412<br>E: 593378 |
| Ravn River Area** | Conveyed to Mine Site Sewage Treatment Facilities | | N/A |
| Mid-Rail Area** | Conveyed to Mine Site Sewage Treatment Facilities | | N/A |
| Cockburn Tunnels Area** | Conveyed to Steensby Sewage Treatment Facilities | | N/A |
| Cockburn South Camp** | Conveyed to Steensby Sewage Treatment Facilities | | N/A |

*Refer to Site Block Flow Diagrams in Appendix D for Milne Port and Mine Site anticipated annual effluent discharge.

** These sites are part of the Southern Railway Corridor and are not expected to be active in the foreseeable future.

Treated wastewater effluent will be discharged at a distance of least thirty-one metres (31 m) above the Ordinary HWM of any water body or watercourse, or where direct flow into the adjacent water body or watercourse is possible, so that surface erosion is minimized and additional impacts are avoided.

## 6.4 SEWAGE TREATMENT PROCESS DESCRIPTION

The process description for the sewage treatment systems at each site are described in the sections that follow. Note that for design purposes a per capita sewage generation rate of 344 L/person/day had been considered originally, which is higher than the per capita potable water consumption rate of 300 L/person/day. This was to ensure that the sewage treatment systems would have a higher design allowance. For consistency 300 L/person/day will now be used for both potable water consumption and sewage generation. On average sewage generated per person ranges from approximately 100 to 300 litres per day. In addition, actual camp occupancy can be optimized based on potable water conservation measures that can be implemented to reduce per capita water consumption and reduce overall sewage generation from current rates.

### 6.4.1 MILNE PORT

The original on-site STP for Milne Port is a MBR facility that was installed in 2014. Raw sewage generated at the PSC camp is pumped directly via lift stations and sewage lines to the MBR facility at Milne Port. Raw sewage generated at the PWH camp is stored in a raw sewage bladder until it is transported using a vacuum truck to the Milne Port MBR for treatment. A second STP is adjacent to the 380-Person Camp.

Treated effluent from the MBR sewage treatment plant servicing the PSC and PWH accommodations is stored in a series of treated effluent tanks. It is designed such that the effluent tank will be at a low-level during operation. This design allows for delay of discharge should sampling indicate that the effluent

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quality does not meet the applicable criteria. Such delay allows the effluent to be mixed, re-treated, and retested before discharge. Once sampling indicates that effluent meets discharge criteria the treated effluent stream is directed to discharge via truck or pipeline to the ocean outfall discharge location (see Table 6-3 for coordinates). The discharge location at Milne Inlet is shown on the Milne Port Site Layout (Appendix C).

Should discharge of off-spec effluent be necessary from the treated effluent tanks due to volume, the off-spec effluent will be stored in the Milne Port PWSP. The off-spec effluent will be removed by vacuum truck and fed into the sewage plant feed tank for re-processing or treated by means of a pond treatment system (i.e. DAF system). Should there be high volumes of off-spec effluent greater than the capacity of the existing PWSP, the Type A Water Licence allows for the construction of a second PWSP to be built at Milne Port. This second PWSP (No. 2) would work in parallel with the existing PWSP and be treated in the same manner.

In the event that there is an electrical power outage that causes the STP(s) to become inoperable, raw sewage will be temporarily trucked to local existing PWSPs until the STP(s) come on line again. Partially or untreated sewage from the PWSPs from this event will either be trucked back to the treatment plant(s) for treatment/reprocessing or treated in situ at the pond location (refer to Appendix G - PWSP Effluent Discharge Plan). The PWSP Effluent Discharge Plan is used as a reference guideline by the onsite environmental team. Water quality parameters will be monitored in the spring and a discharge plan will be developed based on the determined water quality conditions. Discharges from Project PWSPs will be monitored and treated as outlined in the PWSP Effluent Discharge Plan to ensure effluent discharged meets the applicable water quality criteria outlined in the Type A Water Licence. In the event that water treatment methods differ significantly from the PWSP Effluent Discharge Plan, Baffinland will seek third party consultation to determine the appropriate water treatment methods.

The sludge generated by the MBR is de-watered using a mechanical de-watering device, a filter press, and then incinerated or backhauled for disposal off site. Sludge is stored in an animal proof secure area. Odour generation is limited as a result of the sludge being aerobically digested, de-watered and double bagged. Sewage sludge also accumulates in the bottom of the lift stations that service the accommodations camps at Project sites. Regular maintenance of the lift stations includes the periodic removal of the accumulated sewage sludge.

The sewage treatment system basis as described above will be applicable for current and future construction and operations requirements. The site layout showing the location of camp, sewage treatment and ancillary facilities is presented in Appendix C.

### 6.4.2 MINE SITE

The Mine Site has two (2) MBR STP facilities to service the MSC and the Sailiivik Camp Complex. Effluent is discharged via a direct effluent discharge line from the STP servicing the Sailiivik Camp Complex and Mine Site Complex to the approved discharge locations near the Mary River. The Rotating Biological Contactor (RBC) STP (Seprotech manufactured), previously used to treat sewage from the Mine Site

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Weatherhaven Camp, is currently being used as a temporary holding facility/surge tank for the Mine Site Weatherhaven Camp. Raw sewage is transported from the RBC by vacuum truck to the MBR STPs for treatment.

Treated effluent from the MBR STPs is stored in a series of treated effluent tanks. It is designed such that the effluent tanks will be at a low level during operation. This design allows for delay of discharge should sampling indicate that the effluent quality does not meet the applicable criteria. Such delay allows the effluent to be mixed, retreated, and retested before discharge. Once sampling indicates that effluent meets discharge criteria the treated effluent stream is directed to discharge via pipelines to the Mary River discharge locations; one pipeline from the MSC MBR and one pipeline for the Sailiivik Camp MBR (refer to Table 6-3 for winter and summer discharge co-ordinates). The discharge locations at the Mine Site are shown on the Mine Site Layout presented in Appendix C.

To reduce potential sedimentation and/or erosion, riprap (i.e. coarse aggregate) has been used at the approved Mary River discharge locations. Mary River discharge locations are presented in the Mine Site Layout found in Appendix C.

In the event that there is an electrical power outage that causes the STP(s) to become inoperable, raw sewage will be temporarily trucked to local existing PWSPs until the STP(s) come on line again. Partially or untreated sewage from the PWSPs from this event will either be trucked back to the treatment plant(s) for treatment/reprocessing or treated in situ at the pond location (refer to Appendix G - PWSP Effluent Discharge Plan). The PWSP Effluent Discharge Plan is used as a reference guideline by the onsite environmental team. Water quality parameters will be monitored in the spring and a discharge plan will be developed based on the determined water quality conditions. Discharges from Project PWSPs will be monitored and treated as outlined in the PWSP Effluent Discharge Plan to ensure effluent discharged meets the applicable water quality criteria outlined in the Type A Water Licence. In the event that water treatment methods differ significantly from the PWSP Effluent Discharge Plan, Baffinland will seek third party consultation to determine the appropriate water treatment methods.

The sludge generated at the MBR is dewatered using a mechanical dewatering device, a filter press, and then incinerated or backhauled for disposal off site. Sludge cake is stored in an animal proof secure area. Odour generation is limited as a result of the sludge being aerobically digested, de-watered and double bagged. Sewage sludge also accumulates in the bottom of the lift stations that service the accommodations camps at Project sites. Regular maintenance of the lift stations includes the periodic removal of the accumulated sewage sludge.

The MBR STPs are designed to also process raw or partially treated sewage from the Raven and Mid-Rail camps in the event these facilities are operational.

The sewage treatment system basis as described above is adequate for current construction and operations requirements. The modular nature of the plants makes it very simple to add containerized plants for increased sewage treatment capacity. The site layout showing the location of camps, sewage treatment plants and ancillary facilities is presented in Appendix C.

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# 7 WASTEWATER MANAGEMENT – OILY WATER

There are two sources of potentially oily water that have been identified at Milne Port and the Mine Site. There is the wash-water generated at the vehicle maintenance facilities, waste management building, emergency response garage, and truck wash, as well as the surface water that collects within the bulk fuel storage berms, hazardous waste storage berms and Landfarm facilities at Project sites. Based on the different nature of these two wastewater sources, distinct discharge criteria (and treatment plans) have been developed for each.

## 7.1 OILY WATER TREATMENT DISCHARGE CRITERIA

All discharge from the Oily Water/Wastewater Treatment Facilities for monitoring stations MP-02, MS-02, and SP-02 will not exceed the following effluent quality limits provided in Table 7-1.

**TABLE 7-1: EFFLUENT DISCHARGE QUALITY LIMITS FOR OILY WATER TREATMENT FACILITIES***

| Parameter | Maximum Concentration of Any Grab Sample (mg/L) |
|---|---|
| pH | 6 – 9.5 |
| TSS | 35 |
| Ammonia | 4 |
| Phosphorous | 4 |
| Benzene | 0.370 |
| Ethylbenzene | 0.090 |
| Toluene | 0.002 |
| Oil and Grease | 15 and no visible sheen |
| Arsenic | 0.50 |
| Copper | 0.30 |
| Lead | 0.20 |
| Nickel | 0.50 |
| Zinc | 0.50 |

*Source: Type A Water Licence (2AM-MRY1325 – Amendment No. 1) Table 6.

All discharge from Bulk Fuel Storage Facilities will not exceed the following effluent quality limits outlined in Table 7-2. Applicable monitoring stations include MP-03, MP-MRY-7, MS-03, MS-04, MS-MRY-6, SP-04 and SP-05.

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**TABLE 7-2: EFFLUENT DISCHARGE QUALITY LIMITS FOR THE BULK FUEL STORAGE FACILITIES***

| Parameter | Maximum Concentration of any Grab Sample (mg/L) |
|---|---|
| Benzene | 0.370 |
| Toluene | 0.002 |
| Ethylbenzene | 0.090 |
| Lead | 0.001 |
| **Oil and Grease** | 15 and no visible sheen |

*Source: Type A Water Licence (2AM-MRY1325 Amendment No. 1) Table 8

All discharge from Landfarm Facilities, including the Contaminated Snow Containment Berms, will not exceed the following effluent quality limits outlined in Table 7-3. Applicable monitoring stations include MP-04, MS-05 and SP-06.

**TABLE 7-3: EFFLUENT DISCHARGE QUALITY LIMITS FOR THE LANDFARM FACILITIES***

| Parameter | Maximum Concentration of any Grab Sample (mg/L) |
|---|---|
| pH range | Between 6.0 and 9.0 |
| Total Suspended Solids | 15 |
| Oil and Grease | 15 and no sheen |
| Total Lead | 0.001 |
| Benzene | 0.370 |
| Toluene | 0.002 |
| Ethylbenzene | 0.090 |

*Source: Type A Water Licence (2AM-MRY1325 - Amendment No. 1) Table 9

## 7.2 OILY WATER/WASTEWATER TREATMENT PROCESS DESCRIPTION

Oily water and wastewater generated by the Project shall be treated at the Oily Water/Wastewater Treatment Facilities allowed under the scope of the Type A Water Licence. The process description for both oily water/wastewater treatment systems at each site are described in the sections that follow.

### 7.2.1 MANAGEMENT OF OILY WATER AT MILNE PORT

Sources of oily water that may be generated at Milne Port (excluding minor oily water generated from accidental spills which is addressed under the Spill Contingency Plan; SCP) are:

- Vehicle maintenance and wash facilities (i.e. truck wash, snow/ice melt, equipment and floor wash down water);
- Bulk fuel storage facility (water in the tank farm containment areas);
- Concrete sumps in buildings such as Maintenance Shops, Waste Management Building, Emergency Response Building, etc.;

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- Lined containment facilities (i.e. hazardous waste and product storage berms); and,
- Landfarm Facility including the Contaminated Snow Containment Facility.

All possible sources listed above are shown in the Milne Port layout presented in Appendix C.

Any oily water generated from the Milne Port Bulk Fuel Storage Facility or other lined containment facilities is collected in sump(s) within each facility. The water is then treated directly by the prefabricated mobile Oily Water Separator (OWS) contained within a 40' seacan or an on-site constructed OWS. The prefabricated mobile OWS uses a series of skimmers, filters, clay, and activated carbon to capture and remove hydrocarbons from oily water.

Wash and melt water generated at the vehicle maintenance facilities, waste management building, and emergency response garage collects in each building's designated sump(s) by gravity flow. Suspended material in the wastewater settles out in the sump. All sump water collected in these buildings is collected and stored at engineered lined containment facilities until the water can be treated during the open water season using the mobile OWS system. Following treatment by the OWS, the treated effluent is pH adjusted, if required, and resampled to ensure effluent water quality meets the applicable discharge criteria before the effluent is finally discharged to the receiving environment.

All effluent discharges of treated oily water/wastewater to the receiving environment will be discharged to meet effluent discharge criteria outlined in Section 7.1. The Oily Water Treatment and Discharge Plan is included in Appendix L.

### 7.2.2 MANAGEMENT OF OILY WATER AT THE MINE SITE

Sources of oily water that may be generated at the Mine Site (excluding minor oily water generated from accidental spills which is addressed under the SCP) are:

- Vehicle maintenance and wash facilities (i.e. truck wash, snow/ice melt, equipment and floor wash down water);
- Bulk fuel storage facilities (water in the tank farm containment areas);
- Concrete sumps in buildings such as Maintenance Shops, Waste Management Building, Emergency Response Building, etc.; and,
- Lined containment facilities (i.e. hazardous waste and product storage berms).

All possible sources listed above are shown in the Mine Site layout presented in Appendix C.

Wash and melt water generated at the vehicle maintenance facilities, truck wash, waste management building, and emergency response garage collects in each building's designated sump(s) by gravity flow. Suspended material in the wastewater settles out in the sump. All sump water collected in these buildings will be transferred to totes that will be stored in hazardous containment lined facilities. The water in these totes will be discharged and treated in lined berms utilizing the mobile OWS system or shipped off site for disposal at an accredited treatment facility.

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The Truck Wash Facility is equipped with an oily water treatment plant as well as trays and a sump to capture all wash water generated at the facility, allowing it to recycle up to 90% of the water used. Wash water produced in the truck wash facility (truck washing, equipment and floor wash down) will flow by gravity and be collected in the trays and a local sump. Suspended material in the wastewater is removed using a series of sumps, settling tanks (de-muck tank) and filters. Free and emulsified oil in the wastewater is removed by the facility's oily water treatment plant which utilizes a series of skimmers, activated carbon and filters in order to substantially reduce oil levels in the recycled wastewater. The water is then reused by the facility to wash down equipment and vehicles. Should there need to be a discharge from the facility to the receiving environment, the wastewater is further treated with the facility's reverse osmosis unit and pH controller to ensure the final effluent meets all discharge criteria outlined in the Type A Water Licence.

Treated effluent from the truck wash's oily water treatment plant will be pumped to the discharge outfall at the Mary River or other on land location as agreed to by the Water Licence Inspector. Most water is recycled and reused within the facility. The separated waste oil will be stored in a local tank. Periodically, the oil from the tank will be drained and shipped off site or incinerated. Accumulated suspended solids will be periodically removed by bucket loader vehicle and sent to the Landfarm Facility for treatment if contaminated with hydrocarbons or the landfill if demonstrated to be non-hazardous.

Collected stormwater run-off from the Mine Site Bulk Fuel Storage Facility and/or other lined containment facilities (i.e. hazardous waste berms, etc.) will be treated using the mobile OWS system and discharged directly to the adjacent land surface. As mentioned prior, the mobile OWS system is a prefabricated mobile oily water separator contained within a 40' seacan. The mobile OWS system uses a series of skimmers, filters, clay and activated carbon to capture and remove oils and hydrocarbons from wastewater. Effluent from the mobile OWS will be sampled regularly to ensure effluent quality meets the applicable discharge criteria outlined in the Type A Water Licence. The Oily Water Treatment and Discharge Plan is included in Appendix L.

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# 8 WASTEWATER MANAGEMENT – CONTACT WATER

Contact water for the purposes of this Plan is defined as water that has come in contact with ore or waste rock; it is considered to be the equivalent to mine effluent as defined under the MDMER. The water management ponds described in the sections below retain runoff water from the Milne Port ore stockpile pad and the Mine Site crushing pad, Run of Mine Stockpile (ROM), and waste rock stockpile. In the event of abnormal conditions at an existing surface water management pond, Baffinland will consult an engineer for recommendations on required improvements or upgrades.

## 8.1 DISCHARGE CRITERIA

All discharge from the water management ponds (MS-06, MS-07, MS-08, MS-09, and SP-07) associated with the Project's mining operations (crushing, ore, and waste rock stockpiles) will not exceed the effluent quality limits outlined in the Type A Water Licence and provided in Table 8-1.

In addition, effluent discharged from water management ponds at the Mine Site (MS-06, MS-07, MS-08, MS-09) will not exceed the effluent quality limits within the MDMER provided in Table 8-2. When the maximum limit for a parameter differs between the MDMER and the Type A Water Licence discharge criteria, the more conservative (lower) limit for the parameter will be adopted.

**TABLE 8-1: EFFLUENT DISCHARGE QUALITY LIMITS FOR OPEN PIT, STOCKPILES, AND SURFACE WATER MANAGEMENT PONDS (NWB)***

| Parameter | Maximum Concentration of Any Grab Sample (mg/L) |
|---|---|
| Total Arsenic | 0.50 |
| Total Copper | 0.30 |
| Total Lead | 0.20 |
| Total Nickel | 0.50 |
| Total Zinc | 0.50 |
| Total Suspended Solids | 15 |
| Oil and Grease | No visible sheen |
| Toxicity | Not acutely toxic |
| pH | 6.0 – 9.5 |

*Source: Type A Water Licence (2AM-MRY1325 – Amendment No. 1) Table 10.

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**TABLE 8-2: EFFLUENT DISCHARGE QUALITY LIMITS FOR OPEN PIT, STOCKPILES, AND SURFACE WATER MANAGEMENT PONDS (ECCC)***

| Parameter | Mean Monthly Limit (mg/L)[1] | Maximum Concentration of Any Grab Sample (mg/L) |
|---|---|---|
| Total Arsenic | 0.50 | 1.00 |
| Total Copper | 0.30 | 0.60 |
| Total Lead | 0.20 | 0.40 |
| Total Nickel | 0.50 | 1.00 |
| Total Zinc | 0.50 | 1.00 |
| Total Suspended Solids | 15 | 30 |
| Radium-226 | 0.37 Bq/L | 1.11 |
| pH | 6 – 9.5 | 6 – 9.5 |
| Toxicity | Not acutely toxic | Not acutely toxic |
| Un-ionized Ammonia | 0.50 | 1.00 |

*Source: Metal and Diamond Mining Effluent Regulations, Schedule 4

[1] Parameters listed above are sampled weekly during discharge.

Additional parameters including sub-lethal toxicity, aluminum, cadmium, iron, mercury, molybdenum, selenium, nitrate, ammonia, chloride, chromium, cobalt, sulphate, thallium, uranium, phosphorus, manganese, hardness, alkalinity and specific conductance are also required under MDMER, however these parameters do not have a maximum water quality discharge limit but instead are used to provide additional information to assist in interpreting toxicity results and identifying potential effects on the receiving environment. For additional information on the MDMER requirements pertaining to the Project refer to Appendix I.

## 8.2 MILNE PORT STOCKPILE SURFACE WATER MANAGEMENT PONDS

The three (3) Milne Port stockpile surface water management ponds were constructed to retain the runoff water from the Milne Port ore stockpile area and to contain the sediment load.

During normal operation, runoff from the stockpile area drains to the stockpile surface water management ponds. The ponds were designed with sufficient retention time to ensure the sediment will gravity-settle to the bottom of the pond and allow the runoff to be tested before the water reaches the overflow weirs. The ponds are equipped with overflow weirs designed to allow the unloaded surface water to drain through a controlled discharge to Milne Inlet. Alternatively, the pond can be pumped out using a portable pump arrangement.

In the case that the surface water management pond effluent quality does not meet the discharge criteria outlined in the Type A Water Licence by means of sediment gravity settling alone, additional treatment methods (i.e. flocculants, GAC, clay, filters, etc.) will be employed to ensure effluent compliance.

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## 8.3 MINE SITE ORE CRUSHER PAD SURFACE WATER MANAGEMENT POND

The Mine Site ore crusher pad surface water management pond is designed to retain the runoff water from the Mine Site Crusher Facility (CF) and contain the sediment load, particularly during seasonal freshet activities. During normal operation, runoff from the crusher area drains to the surface water management pond (west of the crusher pad). The pond is equipped with an overflow weir designed for extreme weather periods (e.g. greater than a 1 in 10 year, 24 hour design storm), allowing the unloaded surface water to drain through a controlled discharge to Sheardown Lake. The pond was designed with sufficient retention time to ensure the sediment would gravity-settle to the bottom of the pond before the water reaches the overflow weir.

The pond is also equipped with a pump pad on the northwest side. The normal operation of the pond is to test the water quality for MDMER and applicable Type A Water Licence requirements and when on spec, control discharge using a portable pump arrangement. The pump arrangement connects into the treated effluent discharge pipeline originating at the MSC STP for discharge to Mary River.

In the case that the surface water management pond effluent quality does not meet the applicable discharge criteria by means of sediment gravity settling alone, additional treatment methods (i.e. flocculants, GAC, clay, filters, etc.) will be employed to ensure effluent compliance.

## 8.4 MINE SITE RUN OF MINE STOCKPILE SURFACE WATER MANAGEMENT POND

The Mine Site Run of Mine (ROM) stockpile infrastructure, when constructed, will support Deposit No. 1 mining operations and is to be located off the Mine Haul Road. Stormwater runoff originating in the ROM stockpile is intercepted by the Facility's perimeter collection ditches and directed to the ROM pond. The ROM pond is designed to retain the runoff and contain the sediment load, particularly during freshet activities. During normal operation, runoff from the ROM stockpile drains to the surface water management pond. The pond is equipped with an overflow weir designed for extreme weather periods (e.g. greater than a 1 in 200 year, 24 hour design storm), allowing the unloaded surface water to drain through a controlled discharge to Mary River.

In the case that the surface water management pond effluent quality does not meet the applicable discharge criteria by means of sediment gravity settling alone, additional treatment methods (i.e. flocculants, GAC, clay, filters, etc.) will be employed to ensure effluent compliance.

## 8.5 MINE SITE WASTE ROCK STOCKPILE POND

The Waste Rock Facility Surface Water Management Pond (WRF Pond) was constructed to support Deposit No. 1 mining operations and is located northeast of the Deposit No. 1 open pit. Seepage and stormwater runoff originating from the Waste Rock Stockpile is intercepted by the Facility's perimeter collection ditches and directed to the WRF Pond. The WRF Pond for the Mine Site was constructed in 2016 and is designed to retain surface water runoff. Controlled transfers of in pit mine water to the WRF Pond

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for treatment through the WTP may also occur in accordance with Baffinland's Surface Water and Aquatic Ecosystem Management Plan (SWAEMP).

Water from the WRF Pond is pumped into the Water Treatment Plant (WTP) for pH adjustment, and subsequently discharged into a geotube adjacent to the WTP for solids removal via filtering and settling. The WTP has a design treatment rate of 280 $m^3$/hr capacity, consisting of two 140 $m^3$/hr treatment trains. For each train, the water flow rate and pH in Reactor Tanks 1 and 2 is continuously monitored. Ferric sulfate and polymer is added based on flow rate, while the lime dosage is based on the pH in Reactor Tank 1. The chemical dose rate is adjusted by the plant operator using the PLC to achieve water quality requirements. Monitoring of the treated effluent at various stages of the treatment system is conducted to monitor the treatment system's performance. The Waste Pond Water Treatment Plant Operations SOP, which includes plant operating procedures as well as an overview of the treatment process, and General Arrangement Drawings is provided in Appendix K. Additional contingency water treatment measures are described in Section 9.2 of the Phase 1 Waste Rock Management Plan.

The effluent from the geotube is tested to ensure it meets MDMER and applicable Type A Water Licence criteria and then controlled discharged intermittently using a portable pump arrangement. Sludge generated from the operation of the WRF WTP is assessed for suitability of disposal within the WRF, or disposed of off-site at an appropriate waste receiving facility. Following the Final Discharge Point (FDP), effluent passes through approximately 475 metres (m) of layflat hose and is discharged to the tundra of the approved receiving environment, the Mary River watershed.

In high rainfall periods (e.g. greater than a 1 in 10 year, 24 hour design storm), the WRF Pond is also equipped with an overflow weir on the north side designed to allow the unloaded surface water to drain through a controlled discharge diversion channel. The WRF Pond was designed with sufficient retention time to ensure the sediment would gravity-settle to the bottom of the pond before the water reaches the overflow weir. However, controlled discharges from the pond via active pumping are implemented.

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# 9 LANDFILL

## 9.1 DISCHARGE CRITERIA

All runoff and seepage from the Landfill Facilities at monitoring stations MS-MRY-13A, MS-MRY-13B and SP-08 will not exceed the following effluent quality limits presented in the table below:

**TABLE 9-1: EFFLUENT DISCHARGE QUALITY LIMITS FOR THE LANDFILL FACILITIES***

| Parameter | Maximum Concentration of Any Grab Sample (mg/L) |
|---|---|
| pH range | Between 6.0 and 9.5 |
| Total As | 0.5 |
| Total Cu | 0.3 |
| Total Pb | 0.2 |
| Total Ni | 0.5 |
| Total Zn | 0.5 |
| TSS | 15 |
| Oil and Grease | No visible sheen |

*Source: Type A Water Licence (2AM-MRY1325 - Amendment No. 1) Table 7

## 9.2 MINE SITE LANDFILL

The Mine Site Landfill Facility is located just south of the NE Basin of Sheardown Lake. Both Facility's monitoring stations, MS-MRY-13A and MS-MRY-13B, are sampled monthly during the open water season and are situated on a small stream down gradient of the Landfill Facility. The small stream drains into the NE Basin of Sheardown Lake on its southern shoreline. Refer to the Mine Site Layout presented in Appendix C for the exact location of the monitoring stations and Landfill Facility.

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# 10 OPERATIONS AND MAINTENANCE (O & M)

The project specific O&M Manual for Sewage Treatment Systems is provided by Newterra Ltd in Appendix E. Sample plans for operation and maintenance of the potable water and oily water systems are given below. These plans were provided by the vendors of the potable and oily water treatment systems.

## 10.1 POTABLE WATER TREATMENT SYSTEM O & M PLAN

### 10.1.1 REGULAR MAINTENANCE SCHEDULE

The potable water system is fully automatic, and only requires limited supervision and regular maintenance. The following maintenance schedule provided in Table 10-1 is subject to regulations from local government, and instructions from original equipment manufacturers. The following maintenance schedule is common for all potable treatment plants.

**TABLE 10-1: RECOMMENDED MAINTENANCE SCHEDULE - POTABLE TREATMENT PLANTS**

| Items | Description |
|---|---|
| Daily | • Alarm check.<br>• Chemical storage level check.<br>• Controller time check.<br>• Pressure gauge check.<br>• Total and free chlorine testing.<br>• Turbidity check. |
| Monthly | • Turbidity analyzer check/calibration.<br>• Residual chlorine/pH analyzer check/calibration. |
| Annual | • Filter media level check, and refill if required.<br>• UV lamp replacement. |

### 10.1.2 MONITORING PLAN

The monitoring plan is subject to local regulations of drinking water and other related codes. The following instruments are used to monitor the operation and performance of the potable water system.

- Inlet flow meter: to monitor feed flow, backwash flow, rinse flow and filtered flow;
- Effluent turbidity analyzer: to monitor turbidity in produced water; and,
- Effluent pH/residual chlorine analyzer: to monitor pH and residual chlorine of produced water.

The PLC system in the control panel will totalize raw water, produced water, backwash water, chemical injection, pump running time etc.

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Periodically sampling and lab tests for raw water and treated water will be applied to ensure the treated water meets drinking water standards. The frequency of the sampling and testing will be determined by the ministry and outlined in the certificate of approval.

## 10.2 MOBILE OILY WATER SEPARATOR (OWS) SYSTEM

### 10.2.1 SYSTEM OVERVIEW

The mobile OWS is a prefabricated system (Newterra Ltd.) housed in a 40' seacan and is designed to remove oil, grease and BTE compounds from hydrocarbon contaminated water. The unit includes an API type separator to remove free product, a bag filter for solids removal and three adsorption units (one clay, two granular activated carbon) for oil/grease and BTE removal. In the event that the contaminated water has lead concentrations that exceed the discharge limits outlined in Baffinland's Type A Water Licence, additional treatment barrels containing lead removal media are added to the end of the mobile OWS unit. Figure 10-1 shows the Process Flow Diagram for the OWS. The OWS (Newterra Ltd. model OWS-24) is sized for a water temperature of 7°C, specific gravity of 0.88 (diesel/furnace oil), TOG concentration of 50mg/L and flow rate of 50 gpm.

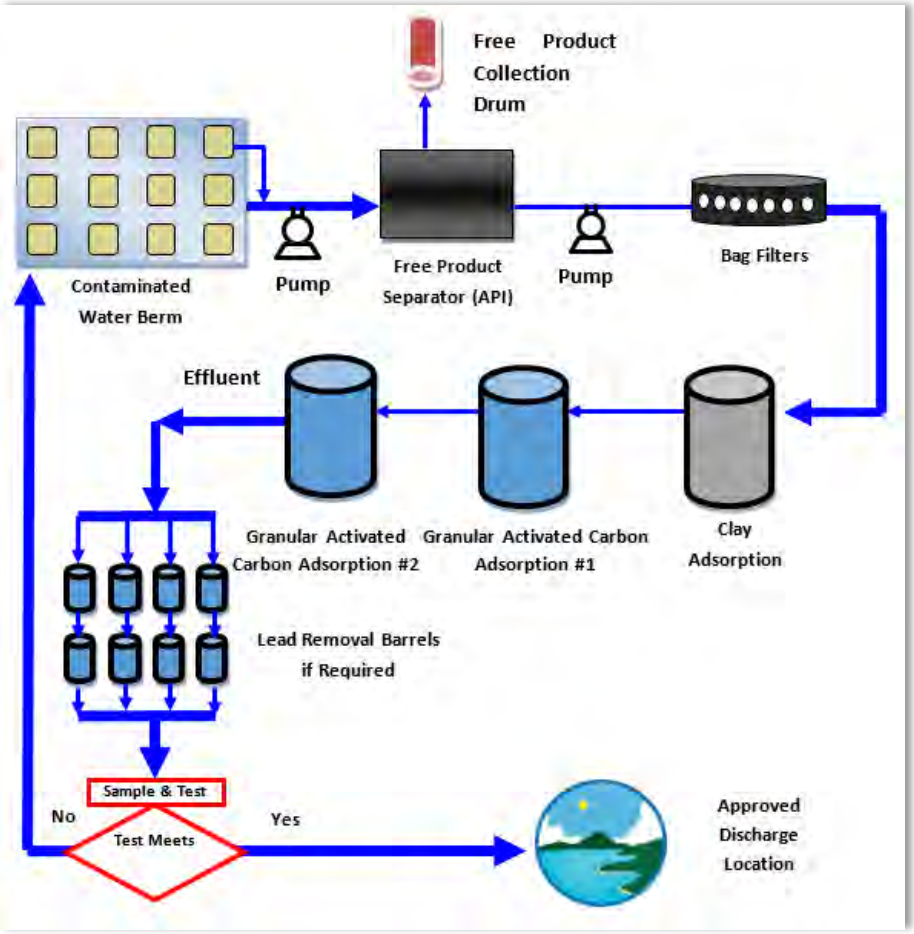



**FIGURE 10-10-1 – MOBILE OWS FLOW PROCESS DIAGRAM**

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### 10.2.2 OPERATION AND MAINTENANCE PLAN

For the O&M procedures and schedule relating to the mobile OWS unit, refer to the Baffinland Mobile Oily Water Separator (OWS) Manual provided in Appendix H.

## 10.3 OILY WATER TREATMENT PLANT (FOR VEHICLE WASH WATER) O & M PLAN

### 10.3.1 REGULAR MAINTENANCE AND MONITORING SCHEDULE

Regular system maintenance entails routine inspection of mechanical and electrical components. It is recommended that the system be inspected weekly to ensure that components are in good working order. Spare parts lists are included with the Operations and Maintenance Manuals, with critical spare parts and system expendables highlighted. Recommended stock quantities are be given.

Operational maintenance is mainly comprised of waste removal and expendable replacement in addition to some preventative maintenance on mechanical components. Maintenance activities, locations and their recommended frequencies are given in Table 10-2.

**TABLE 10-2: MAINTENANCE ACTIVITIES, LOCATIONS AND THEIR RECOMMENDED FREQUENCIES**

| Maintenance Task | Location | Frequency |
|---|---|---|
| Sludge/sediment removal | De-muck tank | Twice/week |
| Oil Removal | Waste oil storage | Weekly |
| Media change out | CMAFU-2 | TBD |
| Media change out | DPL30 | TBD |
| Filter change out | Reverse Osmosis Unit | TBD |
| Membrane cleaning | Reverse Osmosis Unit | TBD |
| Media change out (plates) | Oil Coalescing System | TBD |
| Pump seals | Various | Annually |

Additional, non-routine maintenance will be required throughout the life of the equipment. The recommended spare parts list and appropriate site stock levels are designed to keep the system running continuously with only scheduled downtime.

In addition to maintenance, monitoring the system performance and effluent quality are also necessary. A flow totalizer will be used at the effluent discharge to accurately summate the volume of treated water being released. This in conjunction with the quality data from the various system flows will allow forecasting for media and consumable change-out as well as waste oil and sludge/sediment generation. Residual contaminants below the regulatory limits can also be used in conjunction with treated volumes to determine area loadings over certain periods of time.

Monitoring tasks, locations and frequencies are listed in Table 10-3. The prefix, GI, in the task column denotes “General Inspection”. The Truck Wash Facility layout and component O & M manuals are presented in Appendix J.

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**TABLE 10-3: MONITORING TASKS, LOCATIONS AND FREQUENCIES**

| Monitoring Task | Location | Frequency |
|---|---|---|
| GI – solids/liquid separators (levels, appearance, pump operation) | De-muck system, CMAFU-2 | Daily |
| Sample – solids/liquid separator effluent | CMAFU-2 effluent | TBD |
| GI – OWS (levels, appearance, dosing pump) | OWS room | Daily |
| Sample – OWS Inlet | CMAFU-2 effluent | TBD |
| GI – Chemical Treatment (tanks, totes, levels, appearance, mixers, dosing pumps, effluent pump, pressures) | Chemical room | Daily |
| GI – Filtration (units, pressures) | Reverse Osmosis Unit | Daily |
| GI – Media Vessels (units, pressures, backwash pump, treated water storage) | OCS Tank, DPL30 | Daily |
| Sample – OWS outlet | DPL30 effluent | Quarterly/Monthly |
| Sample – Reverse osmosis effluent | Reverse Osmosis Unit effluent | Quarterly/Monthly |
| GI – Miscellaneous (vertical heaters, air compressors, air dryers, controls) | Various | Daily |

A joint maintenance/monitoring log is kept to ensure that operational data and changes/responses are properly documented.

The monitoring guidelines are recommended as a minimum to ensure proper operation, health, safety and the protection of the surrounding environment. If corporate or regional policies in effect or enacted require more stringent monitoring, the scope and schedule will be adjusted to meet these requirements.

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# 11 CONTINGENCY MEASURES

Design criteria for the potable, sewage and oily water treatment systems and discharge criteria for surface water management ponds have been reviewed and revised to provide additional safety factors.

To effectively manage emergency responses, Baffinland has adopted a tiered emergency classification scheme (Figure 11-1). Each level of emergency, based on its severity, requires varying degrees of response, effort, and support. Each level has distinct effects on normal business operations, as well as requirements for investigation and reporting. Levels of classification specific to spill response are as follows:

Level 1 (Low) – Minor accidental release of a deleterious substance with:

- No threat to public safety; and/or
- Negligible environmental impact to receiving environment.

Level 2 (Medium) – Major accidental release of a deleterious substance with:

- Some threat to public safety; and/or
- Potential Moderate environmental impact to receiving environment

Level 3 (High) – Uncontrolled hazard which:

- Jeopardizes project personnel safety: and/or
- Potential significant environmental impacts to receiving environment.

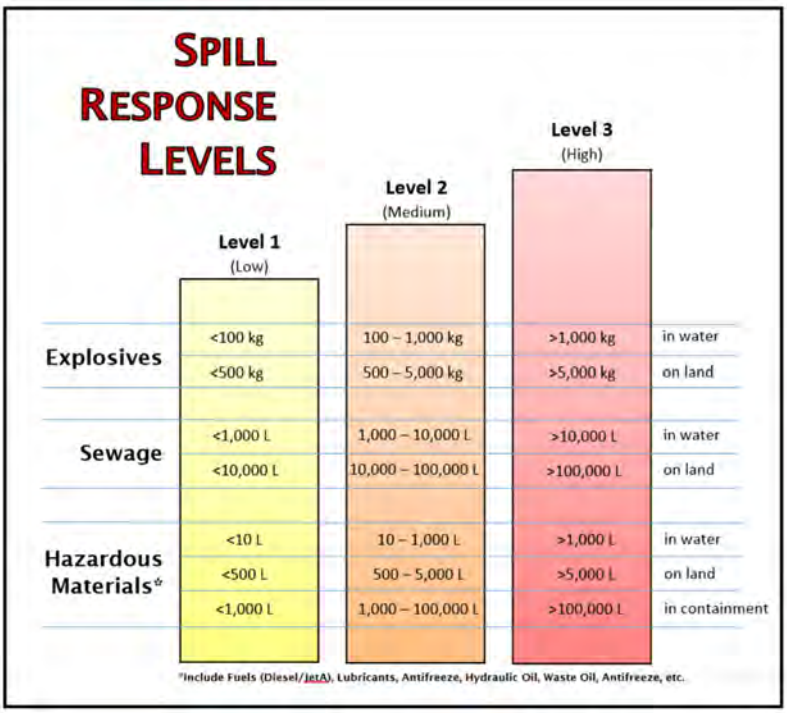



**FIGURE 11-1 - EMERGENCY SPILL REPONSE LEVELS**

The sewage treatment systems are set back sufficiently from surface water bodies and are fully enclosed units. In the event of a spill of untreated or partially treated sewage from these facilities, Baffinland will

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follow the procedures in its SCP and Emergency Response Plans. In the event that sewage discharge does not meet applicable discharge criteria, raw sewage will be temporarily trucked to the existing PWSPs or to another on-site STP for treatment. Partially or untreated sewage from the PWSPs from this event will either be trucked back to the treatment plant(s) for treatment/reprocessing or treated in situ at the pond location (refer to Appendix G - PWSP Effluent Discharge Plan). The PWSP Effluent Discharge Plan is used as a reference guideline by the on-site environmental team. Water quality parameters will be monitored in the spring and a discharge plan will be developed based on the determined water quality conditions. Discharges from Project PWSPs will be monitored and treated as outlined in the PWSP Effluent Discharge Plan to ensure effluent discharged meets the applicable water quality criteria outlined in the Type A Water Licence. In the event that water treatment methods differ significantly from the PWSP Effluent Discharge Plan, Baffinland will seek third party consultation to determine the appropriate water treatment methods.

Effluent from the mobile OWS is sampled regularly to ensure effluent quality meets the applicable discharge criteria outlined in the Type A Water Licence. In the case of an accidental spill of oily water, Baffinland will follow the procedures in its SCP and Emergency Response Plans. In the event of a release of oily water in exceedance of applicable discharge criteria, discharge will be ceased immediately and treatment options will be evaluated. Prior to resuming discharge, resampling will occur to ensure effluent water quality meets the applicable discharge criteria before the effluent is finally discharged to the receiving environment.

Surface water management ponds are discharged in adherence to the MDMER and Type A Water Licence discharge criteria. Workers involved in the pumping operations exercise caution when setting up and operating pumps on the pond liners. While installing the pump's intake hose on an inner tube in a pond, workers will be in particularly close proximity to the water. The workers should ensure they have dry, secure footing while performing this task. When compliant results are received from pre-discharge water samples, surface water management ponds can be discharged.

Discharge is discontinued if internal or external results are approaching or exceed applicable water quality criteria. In the event of non-compliant water, Baffinland will follow the procedures in its SCP and Emergency Response Plans (see Appendix L for the MDMER Emergency Response Plan). In cases where water retained in water management infrastructure is determined to be non-compliant with applicable discharge limits, retained water (effluent) will be treated as per this Plan, the Phase 1 Waste Rock Management Plan, Waste Pond Water Treatment Plant Operations and the MDMER ERP to ensure compliance with the applicable discharge limits. Potential treatment options include use of temporary treatment systems to alter water chemistry with various mixing and dosing components, arranging equipment on the discharge end of the pump/discharge to provide final polishing before the water enters the receiving environment, or incorporation of additional treatment steps to ensure effluent water quality is compliant.

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# 12 MONITORING

Generally, monitoring of the potable and wastewater treatment systems include the following:

- Regular sampling of sewage and wastewater discharge in accordance with the Type A Water Licence requirements;
- More frequent internal process sampling and monitoring to identify potential upset conditions early that could potentially lead to non-compliance;
- Recording of volumes of sewage and wastewater effluent discharged and sludge generated in accordance with the Type A Water Licence requirements;
- Completion of daily checklists related to O&M requirements for the facilities and reporting of any upset conditions that require action; and,
- Implementation of the Aquatic Effects Monitoring Program to confirm/validate environmental predictions.

## 12.1 POTABLE WATER SYSTEM MONITORING

Untreated freshwater will be sampled at active take locations and/or from the raw water tank at the potable treatment plants. Treated potable water will be sampled from the potable treatment plant effluent as well as several locations throughout the distribution system.

Samples are collected at active water take locations for select analyses at frequencies specified in applicable regulations/guidelines. A typical list of parameters which are tested includes the following:

Calcium, Magnesium, Sodium, Potassium, Aluminum, Arsenic, Boron, Barium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Vanadium, Zinc, Tin, pH, Conductivity, Alkalinity as CaCO3, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Turbidity, Phenols, Ammonia ($NH_3$), Sulphate ($SO_4$), Cl, Br, Nitrite ($NO_2$), Nitrate ($NO_3$), Mercury, Hardness as CaCO3, Chemical Oxygen Demand (COD) and Oil and Grease.

Sampling results are compared to the Guidelines for Canadian Drinking Water Quality (GCDWQ).

## 12.2 SEWAGE TREATMENT SYSTEM MONITORING

Treated sewage effluent is monitored and sampled at the locations specified in the Type A Water Licence. The effluent discharge criteria is summarized in Table 6-2.

## 12.3 OILY WATER TREATMENT SYSTEM MONITORING

Treated oily water effluent is monitored and sampled at the locations specified in the Type A Water Licence. The applicable effluent discharge criteria for oily water is summarized in Section 7.1.

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## 12.4 TRAINING AND AWARENESS

Baffinland staff and contractors working on site receive environmental training as part of the site orientation to achieve a basic understanding of their obligations regarding environmental compliance with regulatory requirements, commitments and best practices.

Operations superintendents and contractor supervisors are provided this Plan, and receive additional training with respect to the requirements outlined in this Plan. In addition, supervising level staff and sub-contractors are provided the Operational Environmental Standards (found in the Project's Environmental Protection Plan) as a written guidance for their work.

Targeted environmental awareness training will be provided to both individuals and groups of workers assuming a specific authority or responsibility for environmental management or those undertaking an activity with an elevated high risk of environmental impact. These will be delivered in the form of toolbox meetings or other means as appropriate.

The content of the environmental component of the site orientation will include at a minimum:

a. Location of environmental sensitivities;
b. Location of additional information on environmental matters;
c. Due diligence responsibilities;
d. Responsibilities related to waste management, minimizing noise as necessary, road traffic rules, etc.; and,
e. Principles and necessary steps to avoid encounters with bears or other wildlife and what to do if one such encounter occurs.

## 12.5 COMMUNICATION

The types of communications for which members of the team will participate include the following:

a. Formal written correspondence and meetings with stakeholders;
b. Site visits by community representatives;
c. Design, construction and planning meetings;
d. Field inspections and monitoring reports disseminated by the Environmental Superintendent;
e. Electronic communications;
f. Toolbox meetings;
g. Formal written correspondence and meetings with government regulatory bodies; and,
h. Formal environmental awareness training.

Communications are appropriately recorded and filed for future reference. Where appropriate, copies of communications will be forwarded to Senior Management and the Environmental Superintendent.

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## 12.6 EXTERNAL COMMUNICATIONS

Effective forms of communication include the proactive notification to external stakeholders of Project activity. Project activity updates will be provided to the communities of North Baffin through various means including regular meetings, public notices and radio announcements as appropriate. Baffinland employs Community Liaison Offices to assist in this regard.

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# Appendix A - Sustainable Development Policy, and Health, Safety and Environment Policy

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# Baffinland Iron Mines Corporation

## Health, Safety and Environment Policy

## BAF-PH1-800-POL-0001

## Rev 2

**Approved By:** Brian Penney

**Title:** Chief Executive Officer

**Date:** April 20th, 2018

**Signature:** 


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# DOCUMENT REVISION RECORD

| Issue Date MM/DD/YY | Revision | Prepared By | Approved By | Issue Purpose |
|---|---|---|---|---|
| 05/07/15 | 0 | EM | TP | For Use |
| 03/07/16 | 1 | JS | BP | Minor edits |
| 04/20/18 | 2 | TS | SA/BP | Minor edits |
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This Baffinland Iron Mines Corporation Policy on Health, Safety and Environment is a statement of our commitment to achieving a safe, healthy and environmentally responsible workplace. We will not compromise this policy for the achievement of any other organizational goals.

We implement this Policy through the following commitments:

- Continual improvement of safety, occupational health and environmental performance
- Meeting or exceeding the requirements of regulations and company policies
- Integrating sustainable development principles into our decision-making processes
- Maintaining an effective Health, Safety and Environmental Management System
- Sharing and adopting improved technologies and best practices to prevent injuries, occupational illnesses and environmental impacts
- Engaging stakeholders through open and transparent communication.
- Efficiently using resources, and practicing responsible minimization, reuse, recycling and disposal of waste.
- Reclamation of lands to a condition acceptable to stakeholders.

Our commitment to provide the leadership and action necessary to accomplish this policy is exemplified by the following principles:

- As evidenced by our motto “Safety First, Always” and our actions Health and Safety of personnel and protection of the environment are values not priorities.
- All injuries, occupational illnesses and environmental impacts can be prevented.
- Employee involvement and active contribution through courageous leadership is essential for preventing injuries, occupational illnesses and environmental impacts.
- Working in a manner that is healthy, safe and environmentally sound is a condition of employment.
- All operating exposures can be safeguarded.
- Training employees to work in a manner that is healthy, safe and environmentally sound is essential.
- Prevention of personal injuries, occupational illnesses and environmental impacts is good business.
- Respect for the communities in which we operate is the basis for productive relationships.

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We have a responsibility to provide a safe workplace and utilize systems of work to meet this goal. All employees must be clear in understanding the personal responsibilities and accountabilities in relation to the tasks we undertake.

The health and safety of all people working at our operation and responsible management of the environment are core values to Baffinland. In ensuring our overall profitability and business success every Baffinland and business partner employee working at our work sites is required to adhere to this Policy.



Brian Penney
Chief Executive Officer
April 2018

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# Appendix B -
# Table of Concordance with Type A Water Licence Terms and Conditions

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Table A-1 shows the Part, number and Condition of the Type A Water Licence and the location where the condition is located within the Freshwater Supply, Sewage and Wastewater Management Plan.

**TABLE A-1: CONCORDANCE TABLE - TYPE A WATER LICENCE 2AM-MRY1325 AMENDMENT NO 1**

| Part | Number | Condition | Section/Commitment |
|---|---|---|---|
| B | 11 | The Licensee shall post signs in the appropriate areas to inform the public of the location of infrastructure and/or facilities designed to contain, withhold, divert or retain Water and/or Waste. All signs must be in English, Inuktitut, and French. | Signage, written in English, Inuktitut, and French, will be posted inform the public of the location of infrastructure and/or facilities designed to contain, withhold, divert or retain Water and/or Waste. |
| D | 2 | The Licensee shall submit to the Board for review and acceptance, at least sixty (60) days prior to construction or in a timeframe otherwise approved by the Board in writing, final design and for-construction drawings, stamped and signed by a Professional Engineer, for all infrastructure and/or facilities designed to contain, withhold, divert or retain Water and/or Waste, as authorized under the Licence. | 60 days prior to construction.<br>If more immediate timeline required, Baffinland will issue letter to NWB with early drawings. |

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| Part | Number | Condition | Section/Commitment |
|---|---|---|---|
| | 17 | The Licensee shall submit a Construction Summary Report to the Board, within ninety (90) days following the completion of any structure designed to contain, withhold, divert or retain Waters or Wastes, as authorized by the Board. The construction summary report shall be prepared by an Engineer(s) in accordance with Schedule D, Item 1. | 90 days following the completion of any structure designed to contain, withhold, divert or retain Waters or Wastes, as authorized by the Board. |
| D | 23 | The Licensee shall construct and operate all infrastructure and Facilities authorized by the Board that are designed to contain, withhold, divert or retain Water and/or Waste, in accordance with all applicable legislation and industry standards. | Demonstrated and outlined by this Plan. |
| E | 3 | The Licensee shall obtain all fresh Water for domestic camp use and industrial purposes, during the Construction Phase of the Project, in amounts and from the sources described in Table 2, or from sources otherwise approved by the Board in writing. In addition to the source-specific limits prescribed in Table 2, the Licensee is authorized to use up to one thousand eight hundred and eighty-eight (1,888) cubic metres of Water per day, to a maximum of six hundred and eighty-nine thousand (689,000) cubic metres of Water annually, during the Construction Phase of the Project.<br>**Table 2: Water Use Authorized for Domestic and Industrial Purposes during Project Construction Phase**<br>Site / Source / Volume ($m^3$/day) / Combined Volume ($m^3$/year)<br>Milne Port (Milne Inlet) — Phillips Creek (summer); Km 32 Lake (winter) — 367.5 — ~ 134,000<br>Mine Site (Mary River) — Camp Lake — 657.5 — 240,000<br>SteensbyPort (Steensby Inlet) — ST 347 Km Lake; 3 km Lake — 435.8 — 155,400<br>Ravn River — Camp Lake — 145.2<br>Mid-Rail — Nivek Lake (summer); Ravn Camp Lake (winter) — 79.5<br>Cockburn North (Tunnels Camp) — Cockburn Lake — 101.4<br>Cockburn South Camp — Cockburn Lake — 111.1<br>Annual Total — ~ 689,000 $m^3$/Annually | Table 5-1 |
| E | 5 | The Licensee may recycle water and use reclaimed water from the various Treatment Facilities, surface water management ponds and embankment dams and approved discharge locations under the licence if such waters meet appropriate discharge criteria for those facilities. | 6.2 |

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| Part | Number | Condition | Section/Commitment |
|---|---|---|---|
| E | 6 | The Licensee shall equip all Water intake hoses with screens of an appropriate mesh size, consistent with the requirements of Fisheries and Ocean Canada's (DFO) Freshwater Intake End-of-Pipe Fish Screen Guidelines (1995), to prevent the entrainment of fish are and shall withdraw Water at a rate such that fish do not become impinged on the screen. | 5.1.1.2 |
| E | 8 | Streams cannot be used as a water source unless authorized and approved by the Board in writing. | 6.2 |
| E | 9 | The Licensee shall notify the Inspector and the Board at least ten (10) days in advance of using Water from any sources not identified in the Application or requiring approval as per Part E, Item 8. | 10 days in advance of using Water from any sources not identified in the Application or requiring approval. |
| E | 10 | The Licensee shall update or revise annually following the commencement of the Operations Phase and/or the Early Revenue Phase, the Project Blockflow Diagram Water Supply Balance information for the various Project sites, provided with the Application and submit for review of the Board. The submission shall be included with the Annual Report under Part B, Item 4. | The Plan is updated to include the planned construction numbers as well as the current Work Plan. Updates will be provided as required to include the Operations Phase. |
| E | 11 | The Licensee shall carry out weekly inspections of all structures designed to contain, withhold, divert or retain Waters or Wastes during periods of flow and maintain records of the inspections and findings, for review upon the request by the Board or an Inspector. | 4 |
| E | 12 | The Licensee shall not remove any material from below the ordinary High Water Mark of any water body unless authorized. | 5.2 |
| E | 25 | The Licensee is authorized to withdraw up to 1,500 m3 / day to a maximum of 547,500 m3 annually of Water specifically for use in dust suppression or control along the Tote Road during the Early Revenue Phase (ERP) of the Project. Water for dust suppression or control shall be obtained from the sources in accordance with thresholds established in Table 2-3. | Table 5-2 |

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<table>
<tr><th>Part</th><th>Number</th><th>Condition</th><th>Section/Commitment</th></tr>
<tr><td></td><td></td><td>
Table 2-3: Water use Authorized for Dust Suppression
<table>
<tr><th>Site</th><th>Source</th><th>Prosed Maximum Volume (m$^3$/day)</th><th>Restriction</th></tr>
<tr><td rowspan="14">Tote Road</td><td>Phillip's Creek</td><td>212</td><td rowspan="3">None</td></tr>
<tr><td>Km 32 Lake</td><td>364</td></tr>
<tr><td>CV128</td><td>579.5</td></tr>
<tr><td>CV099</td><td>110</td><td rowspan="3">June –July only during low flow(less than mean flow) years</td></tr>
<tr><td>CV087</td><td>90</td></tr>
<tr><td>CV078</td><td>75</td></tr>
<tr><td>Katiktok Lake</td><td>318</td><td rowspan="2">None</td></tr>
<tr><td>BG50</td><td>150</td></tr>
<tr><td>BG32</td><td>120</td><td>June –July only during low flow(less than mean flow) years</td></tr>
<tr><td>CV217</td><td>130</td><td rowspan="2">None</td></tr>
<tr><td>Muriel Lake</td><td>212</td></tr>
<tr><td>David Lake</td><td>132</td><td>June –July only during low</td></tr>
<tr><td>BG17</td><td>75</td><td>flow(less than mean flow) years</td></tr>
<tr><td>CV233 (Tom River)</td><td>135</td><td rowspan="2">None</td></tr>
<tr><td>Camp Lake</td><td>86</td></tr>
</table>
</td><td></td></tr>
<tr><td>E</td><td>26</td><td>The Licensee shall obtain authorization from the Board in writing prior to using Water authorized under Part E, Item 25, for purposes other than that authorized in Part E, Item 25.</td><td>5.2</td></tr>
<tr><td>F</td><td>9</td><td>The Licensee shall treat oily water and wastewater generated by the Project at the Oily Water/Wastewater Treatment Facilities authorized under the scope of the Licence.</td><td>7.2</td></tr>
<tr><td>F</td><td>11</td><td>The Licensee shall provide at least ten (10) days' notice to the Inspector prior to planned Discharges from any Waste Management Facility, Oily Water/Wastewater Treatment Facilities, Sewage Treatment Facilities, and any other relevant facilities associated with the Project. The notice shall include the estimated volume proposed for Discharge and the location and description of the receiving environment.</td><td>10 days prior to the commencement of any treated effluent discharge.</td></tr>
<tr><td>F</td><td>12</td><td>The Licensee shall, unless otherwise approved by the Board in writing, discharge effluent at a distance of least thirty-one (31) metres above the Ordinary High Water Mark of any Water body, where direct flow into the Water body is not possible, such that surface erosion is minimized and no additional impacts are created.</td><td>Section 6.3</td></tr>
<tr><td>F</td><td>14</td><td>The Licensee shall direct all Sewage generated from the relevant Project sites to the Sewage Treatment Facilities or as otherwise approved by the Board in writing.</td><td>6.2</td></tr>
<tr><td>F</td><td>15</td><td>The Licensee shall treat all Sewage waste generated at the Ravn River and Mid-Rail camps and Sewage generated at the Cockburn North and Cockburn South camps at either the Mine Site Sewage Treatment Facility or the Steensby Port Sewage Treatment Facility, unless otherwise approved by the Board in writing.</td><td>Appendix F</td></tr>
</table>

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<table>
<tr><th>Part</th><th>Number</th><th>Condition</th><th>Section/Commitment</th></tr>
<tr><td>F</td><td>16</td><td>The Licensee shall provide to the Board for review, at least sixty (60) days prior to installation, detailed specifications and operational requirements for the Sewage storage tanks proposed for the Railway camps.</td><td>60 days prior to installation</td></tr>
<tr><td>F</td><td>17</td><td>All discharge from the Sewage Treatment Facilities including the Polishing Waste Stabilization Ponds directly into fresh Water bodies at Monitoring Stations MP-01, MP-01a, MP-MRY-04, MP-MRY-04a, MS-01, MS-01a, MS-MRY-04, MS-MRY-04a, and/or from monitoring stations as otherwise approved by the Board in writing, must not exceed the following Effluent quality limits:<br>Table 4: Effluent Quality Discharge Limits for Sewage Treatment Facilities to Freshwater Receiving Environment<br><table><tr><th>Parameter</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr><tr><td>$BOD_5$</td><td>30</td></tr><tr><td>Total Suspended Solids</td><td>35</td></tr><tr><td>Faecal Coliform</td><td>1000 CFU/100 mL</td></tr><tr><td>Oil and Grease</td><td>No visible sheen</td></tr><tr><td>pH</td><td>Between 6.0 and 9.5</td></tr><tr><td>Ammonia (NH3-N)</td><td>4.0</td></tr><tr><td>Total Phosphorous (MS-01)</td><td>4.0</td></tr><tr><td>Total Phosphorous (MS-01a)</td><td>1.0</td></tr><tr><td>Toxicity</td><td>Not acutely toxic</td></tr></table>(Note that treated effluent discharge from MP-01 and MP-01a is directed to the ocean, therefore ocean discharge criteria (F18) would therefore apply)</td><td>Table 6-2</td></tr>
<tr><td>F</td><td>18</td><td>All discharge from the Sewage Treatment Facilities including the Polishing Waste Stabilization Ponds at Monitoring Stations SP-01, SP-01a, and/or from monitoring stations as otherwise approved by the Board in writing, directly into the ocean or to ditches flowing into the ocean shall not exceed the following Effluent quality limits:<br>Table 5: Effluent Quality Discharge Limits for Sewage Treatment Facilities to the Ocean<br><table><tr><th>Parameter</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr><tr><td>$BOD_5$</td><td>100</td></tr><tr><td>Total Suspended Solids</td><td>120</td></tr><tr><td>Faecal Coliform</td><td>10,000 CFU/100 mL</td></tr><tr><td>Oil and Grease</td><td>No visible sheen</td></tr><tr><td>pH</td><td>Between 6.0 and 9.5</td></tr><tr><td>Toxicity</td><td>Not acutely toxic</td></tr></table>(Note that treated effluent discharge from MP-01 and MP-01a is directed to the ocean, therefore the above ocean discharge criteria are applied for these locations)</td><td>Table 6-2</td></tr>
<tr><td>F</td><td>19</td><td>Sludge generated from the Sewage Treatment Facilities or any other facilities shall be confirmed to be non-hazardous and the results provided to the Board for review prior to disposal at any Landfill Facility or as otherwise approved by the Board in writing.</td><td>6.2</td></tr>
</table>

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<table>
<tr><th>Part</th><th>Number</th><th>Condition</th><th>Section/Commitment</th></tr>
<tr><td>F</td><td>20</td><td>All discharge from the Oily Water/Wastewater Treatment Facilities at Monitoring Stations MP-02, MS-02, SP-02 must not exceed the following Effluent quality limits:<br>Table 6: Effluent Quality Discharge Limits for Oily Water Treatment Facilities
<table>
<tr><th>Parameter</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr>
<tr><td>pH</td><td>Between 6.0 and 9.5</td></tr>
<tr><td>TSS</td><td>35</td></tr>
<tr><td>Ammonia</td><td>4.0</td></tr>
<tr><td>Phosphorous</td><td>4.0</td></tr>
<tr><td>Benzene</td><td>0.370</td></tr>
<tr><td>Ethylbenzene</td><td>0.090</td></tr>
<tr><td>Toluene</td><td>0.002</td></tr>
<tr><td>Oil and Grease</td><td>15 and no visible sheen</td></tr>
<tr><td>Arsenic</td><td>0.50</td></tr>
<tr><td>Copper</td><td>0.30</td></tr>
<tr><td>Lead</td><td>0.20</td></tr>
<tr><td>Nickel</td><td>0.50</td></tr>
<tr><td>Zinc</td><td>0.50</td></tr>
</table></td><td>Table 7-1</td></tr>
<tr><td>F</td><td>21</td><td>All discharge from the Landfill Facilities at Monitoring Stations MS-MRY-13a, MS-MRY-13b and SP-08 must not exceed the following Effluent quality limits:<br>Table 7: Effluent Quality Discharge Limits for the Landfill Facilities
<table>
<tr><th>Parameter</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr>
<tr><td>pH</td><td>Between 6.0 and 9.5</td></tr>
<tr><td>Total As</td><td>0.5</td></tr>
<tr><td>Total Cu</td><td>0.3</td></tr>
<tr><td>Total Pb</td><td>0.2</td></tr>
<tr><td>Total Ni</td><td>0.5</td></tr>
<tr><td>Total Zn</td><td>0.5</td></tr>
<tr><td>Total Suspended Solids</td><td>15</td></tr>
<tr><td>Oil and Grease</td><td>No visible sheen</td></tr>
</table></td><td>Table 8.1</td></tr>
<tr><td>F</td><td>22</td><td>All discharge from the Bulk Fuel Storage Facilities at Monitoring Stations MP-03, MP-MRY-7, MS-03, MS-04, MS-MRY-6, SP-04 and SP-05 must not exceed the following Effluent quality limits:<br>Table 8: Effluent Quality Discharge Limits for the Bulk Fuel Storage Facilities
<table>
<tr><th>Parameter</th><th>Maximum Concentration of Any Grab Sample (ug/L)</th></tr>
<tr><td>Benzene</td><td>370</td></tr>
<tr><td>Toluene</td><td>2</td></tr>
<tr><td>Ethylbenzene</td><td>90</td></tr>
<tr><td>Lead</td><td>1</td></tr>
<tr><td>Oil and Grease</td><td>15,000 and no visible sheen</td></tr>
</table></td><td>Table 7-2</td></tr>
</table>

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<table>
<tr><th>Part</th><th>Number</th><th>Condition</th><th>Section/Commitment</th></tr>
<tr><td>F</td><td>23</td><td>All discharge from the Landfarm Facilities at Monitoring Stations MP-04, MS-05 and SP-06 must not exceed the following Effluent quality limits:<br>Table 9: Effluent Quality Discharge Limits for the Landfarm Facilities<br><table><tr><th>Parameters</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr><tr><td>pH</td><td>Between 6.0 and 9.0</td></tr><tr><td>Total Suspended Solids</td><td>15</td></tr><tr><td>Oil and Grease</td><td>15 and no sheen</td></tr><tr><td>Total Lead</td><td>0.001</td></tr><tr><td>Benzene</td><td>0.370</td></tr><tr><td>Toluene</td><td>0.002</td></tr><tr><td>Ethylebenzene</td><td>0.090</td></tr></table></td><td>Table 7-3</td></tr>
<tr><td>F</td><td>24</td><td>All Discharge from the Bulk Sample Open Pit, Bulk Sample Weathered Ore Stockpile, Bulk Sample Processing Stockpile Area and Bulk Sample Stockpile Area Seepage and runoff from the at Milne Inlet at Monitoring Stations MS-MRY-09, MS-MRY-10, MS-MRY-11, MP-MRY-12 and/or monitoring stations as otherwise approved by the Board shall not exceed the following Effluent quality limits:<br>Table 10: Effluent Quality Discharge Limits for Open Pit, Stockpiles, and Sedimentation Ponds<br><table><tr><th>Parameter</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr><tr><td>Total Arsenic</td><td>0.50</td></tr><tr><td>Total Copper</td><td>0.30</td></tr><tr><td>Total Lead</td><td>0.20</td></tr><tr><td>Total Nickel</td><td>0.50</td></tr><tr><td>Total Zinc</td><td>0.50</td></tr><tr><td>Total Suspended Solids</td><td>15.0</td></tr><tr><td>Oil and Grease</td><td>No visible sheen</td></tr><tr><td>Toxicity</td><td>Not acutely toxic</td></tr><tr><td colspan="2">The waste discharge shall have a pH of between 6.0 and 9.5</td></tr></table></td><td>Table 8-1</td></tr>
<tr><td>F</td><td>26</td><td>All discharge from the Ponds associated with the Run of Mine Ore Stockpile, Ore Stockpile, West and East Sediment Ponds at Monitoring stations MS-06, MS-07, MS-08 MS-09 and SP-07 shall not exceed the Effluent quality limits of Part F, Item 25</td><td>8.1 and Table 8-1</td></tr>
</table>

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# Appendix C -
# Site Layout (Mine Site and Port Site)

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503,000 503,500 504,000 504,500

7,976,500 7,976,000 7,975,500 7,975,000 7,974,500 7,974,000

Milne Inlet

ORE DOCK #1

FREIGHT DOCK

BARGE LANDING AREA

EFFLUENT DISCHARGE LOCATION

SURFACE WATER MANAGEMENT POND

MARINE MANIFOLD BUILDING

SURFACE WATER MANAGEMENT POND

MP-C-A

MP-MRY-12

MP-C-H

MP-06A

MP-06

MP-05

MP-C-D

MP-C-E

MP-C-F

MP-03

MP-C-G

MP-02

MODULE OFFLOAD ROAD

MP-MRY-04A

MP-MRY-7

ORE STOCKPILE

MP-01A

MP-01

LP2

MP-MRY-04

MP-C-B

WEATHERHAVEN (MATRIX CAMP)

SNOW STOCKPILE

SNOW STOCKPILE

LAND FARM FACILITY

MP-C-B

MP-04

SNOW DUMP

MP-C-B01

W3

Phillips Creek

MP-04A

SNOW STOCKPILE

SNOW STOCKPILE

MP-C-C

MP-Q1-02

W14

MAINTENANCE BUILDING

MP-C-B01

ORE HAUL TRUCK SERVICES PAD

HELICOPTER PAD

MP-Q1-02

MOBILE REFUELING MODULE

MP-01B

W10A

QUARRY Q1

W10B

MP-Q1-01

380-PERSON CAMP

LP5

LP3

LP6

LP7

MP-Q1-01

TOTE ROAD

TOTE ROAD (OLD ALIGNMENT)

LAYDOWN R1

MP-C-D

MP-C-E

HAZARDOUS WASTE BERM

MP-C-F

BULK FUEL FACILITY

WELDING SHOP

MP-03

TK-011

TOROMONT SHOP

TK-004

TK-005

DIESEL REFUELING MODULE

MAIN MAINTENANCE BUILDING

JET-A REFUELING MODULE

TK-003

TK-006

MP-02

MOBILE MAINTENANCE FACILITIES

TK-010

TK-009

TK-007

TK-008

ROAD MAINTENANCE SHOP

TK-003

TK-002

ERT OFFICE / GARAGE

TIRE SHOP

MAIN GENERATORS

WAREHOUSE

PORT SITE COMPLEX

POLISHING WASTE STABILIZATION POND

MP-01A

MP-01

WASTE TREATMENT PLANT

ENVIRONMENTAL LAB

WASTE WATER TREATMENT PLANT

WASTE MANAGEMENT BUILDING

HAZARDOUS WASTE BERM

503,000 503,500 504,000 504,500

**LEGEND**

- Foreshore Lease Boundary
- Borrow Area
- Quarry Area
- Project Development Area
- Commercial Lease Boundary
- Current Infrastructure

**SNP Monitoring Station**

- Active
- Inactive

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MARY RIVER PROJECT

## Milne Port Site Layout

Projection: NAD 1983 UTM ZONE 17N.
Base Map: © 2019 Digital Global, Inc.
Imagery and Infrastructure are representative as of August 2019.

0 25 50 100 150 200 Meters

Scale 1:8,000

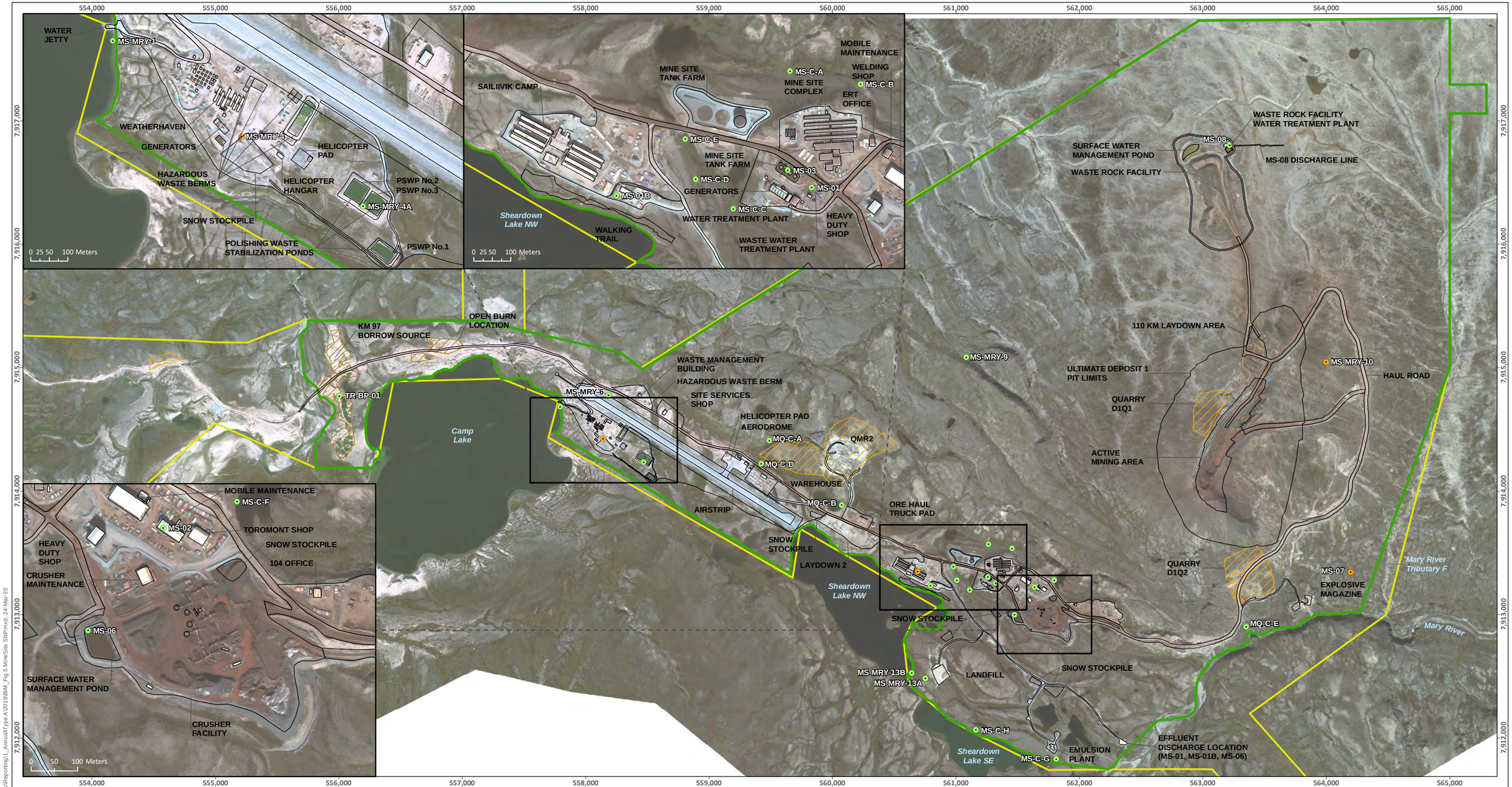
N

Baffinland

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FIGURE 3

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**LEGEND**

- Borrow Area
- Quarry Area
- Project Development Area
- Commercial Lease Boundary
- Current Infrastructure

**SNP Monitoring Station**

- Active
- Inactive

ᓄᓇᕗᑦ ᐅᕙᖃᐅᓯᖏᑦ MARY RIVER PROJECT

## Mine Site Layout

Projection: NAD 1983 UTM ZONE 17N.
Base Map: © 2019 Digital Global, Inc.
Imagery and Infrastructure are representative as of August 2019.

0 100 200 400 600 800 Meters
Scale 1:30,000

N

Baffinland

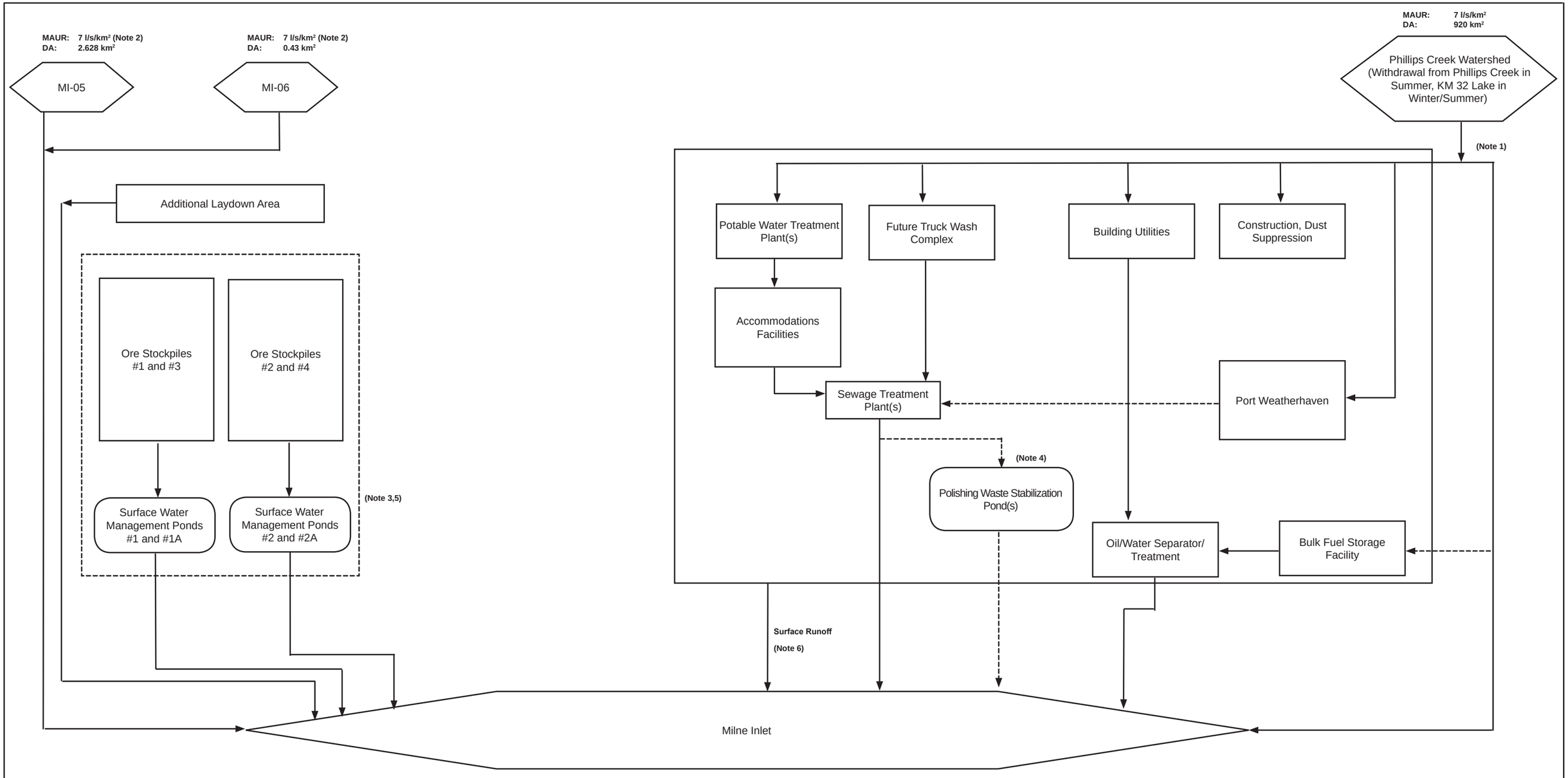
ᑎᑎᕋᐅᖏᓐᓄᑦ FIGURE 5

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# Appendix D -
# Block Flow Diagrams – Milne Port and Mine Site

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LEGEND

- Impacted Watershed
- Development Areas
- Surface Water Management Pond
- Continuous Or Watershed Flow
- Intermittent Flow
- A/AA 100,000 — Annual Volume ($m^3$/year)
- MAUR — Mean Annual Unit Runoff ($l/s/km^2$)
- DA — Drainage Area ($km^2$)

**NOTES:**

1) Raw water supply flow rate from Philips Creek (Summer) & KM32 Lake (Winter/Summer) are currently equal to or less than Type A water license 2AM-MRY1325 Amendment No. 1 flow rate limit of 367.5 $m^3$/day (134,000 $m^3$/year).
2) Mean Annual Unit Runoff (MAUR) in watersheds MI-05 and MI-06 likely range between 5 and 7.1/s/$km^2$. Part of the MI-06 natural catchment will be used for proposed infrastructure construction.
3) Ore stockpiles receive only precipitation and no surface water runoff from surrounding areas.
4) Use of Polishing Waste Stabilization Pond(s) will occur on a contingency basis only, should off-spec treated sewage effluent be produced.
5) Per Hatch Project Memo H349000-2133-10-220-0001, the runoff coefficient from ore stockpiles is zero and only road and pad runoff reports to surface water management ponds.
6) Plant site receives only precipitation-runoff and no surface water runoff from surrounding areas.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 0 | 26MAR'19 | ISSUED WITH TRANSMITTAL | SEF | RAC |

**BAFFINLAND IRON MINES CORPORATION**

**MARY RIVER PROJECT**

**MILNE PORT**
**SITE WATER BALANCE - BLOCK FLOW DIAGRAM**

Baffinland

| PA NO. | REF. NO. |
|---|---|
| NB102-181/54 | NB19-00251 |

**FIGURE A.1** REV 0

MAUR: 9 l/s/km²
DA: 9 km²
MR-08

MAUR: 8.5 l/s/km²
DA: 8.4 km²
MR-10

Waste Rock Facility

Surface Water Management Pond

Waste Rock Facility Water Treatment Plant

MAUR: 6.5 l/s/km²
DA: 8.2 km²
MR-16

MAUR: 9 l/s/km²
DA: 3.1 km²
MR-17

MAUR: 9.7 l/s/km²
DA: 15 km²
MR-12

Ore Crushing Facility

Run of Mine Facility

Surface Water Management Pond

Surface Water Management Pond

MAUR: 8.0 l/s/km²
DA: 5.6 km²
MR-09

Sewage Treatment Plant(s)

Surface Runoff
(NOTE 5)

(NOTE 2)

Polishing Waste Stabilization Pond(s)

Sheardown Lake

Mary River

MAUR: 11.1 l/s/km²
DA: 240 km²

Accommodation Facilities

Potable Water Treatment Plant(s)

Construction, Dust, Suppression, Truck Wash

Bulk Fuel Storage Facility

(NOTE 3)

Utility Buildings

Oil/Water Separator Treatment

Camp Lake

(NOTE 1)

MAUR: 8.5 l/s/km²
DA: 23 km²
(CAMP LAKE)

MAUR: 9.4 l/s/km²
DA: 690 km²

Mary Lake

MAUR: 11.1 l/s/km²
DA: 270.0 km²

Mary River at MR-16 Confluence

LEGEND

- Impacted Watershed
- Development Areas
- Surface Water Management Pond
- Continuous or Uncontrolled Flow
- Intermittent Flow
- A/AA 100,000 Annual Volume (m³/year)
- MAUR Mean Annual Unit Runoff (l/s/km²)
- DA Drainage Area (km²)

**NOTES:**

1) Raw water supply flow rate from Camp Lake are equal to or less than Type A Water Licence 2AM-MRY1325 Amendment No. 1 flow rate limit of 657.5 m³/day (240,000 m³/year) total.
2) Use of Polishing Waste Stabilization Pond and Sheardown Lake discharge will occur on a contingency basis only, should capacity be exceeded through the sewage treatment system discharging to Sheardown Lake.
3) Bulk fuel storage area runoff drained to environment if quality satisfies discharge requirements; otherwise is conveyed to oil/water separator for treatment prior to discharge.

| REV | DATE | DESCRIPTION | PREP'D | RVW'D |
|---|---|---|---|---|
| 1 | 29MAR'19 | ISSUED WITH TRANSMITTAL | SEF | RAC |

**BAFFINLAND IRON MINES CORPORATION**

**MARY RIVER PROJECT**

**MINE SITE**
**SITE WATER BALANCE - BLOCK FLOW DIAGRAM**

Baffinland

PA NO. NB102-181/54

REF. NO. NB19-00268

**FIGURE A.2**

REV 1

# Appendix - E
# Sewage Treatment Plant O & M Manual

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HATCH VENDOR DATA REVIEW

| Doc Number | E349000-PM009-00-118-0001 | Sub | 01 |
|---|---|---|---|
| Date Received | | | |

| Review Grade | Next Submittal Status |
|---|---|
| ☐ C1 – Proceed to next submission & status | ☐ Internal Review ☐ Certified Final ☐ Final ☐ As-Built |
| ☐ C2 – Proceed with exceptions as noted to next submission & status | Next Submittal Date: |
| ☐ C3 – Do not proceed, revise as noted & resubmit | |
| No further submission required - Complete ☐ | |
| ☐ C4 – No further submission required - Cancelled ☐ | |
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# E349000-PM-009-00-118-0001

# Sewage Treatment Plant

# Operations & Maintenance Manual

**newterra** ltd.
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# newterra MicroClear™ Membrane Bioreactor (MBR) Wastewater Treatment Plant

# OPERATION AND MAINTENANCE MANUAL

| | |
|---|---|
| **System:** | **Milne Port & Mine Site Wastewater Treatment Plants** |
| **Location:** | **Baffin Island, Nunavut** |
| **Client:** | **Baffinland Iron Mines Corporation (via Hatch)** |
| **Project:** | **300106** |
| **Rev.:** | **0** |
| **Date:** | **June, 2013** |

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## MANUAL OVERVEW

| Section | Section Title | Section Description |
|---|---|---|
| 1 | **Introduction** | Introduction to **newterra** MBR WWTP O&M Manual |
| 2 | **Safety** | General personal and environmental safety information for operators serving newterra MBR WWTP. |
| 3 | **Wastewater Treatment Plant Design Basis** | **newterra** MBR WWTP Specification, Influent / Effluent Characteristics, and Prohibited Items. |
| 4 | **Plant Installation, Inspection, and Testing** | Overview of general procedures and actions followed during the plant installation, inspection and initial testing. |
| 5 | **Process Control Narrative** | Description of wastewater treatment process and equipment functionality. Control narrative & Control system touchscreen operation. |
| 6 | **System Start-Up, Operating Guidelines and Monitoring** | Overview of the plant start-up procedure & operational conditions; monitoring and testing requirements. |
| 7 | **System Maintenance** | Schedule for Routine Operation and Maintenance Checkups; membrane cleaning. |
| 8 | **Membrane Filtration Unit Shut Down** | Overview of the procedure followed during membrane filtration unit temporary and permanent shut downs; winterization procedure. |
| 9 | **Service & Support** | Information regarding the support services offered by **newterra** ltd. including start-up and emergency services; training sessions during plant commissioning. |
| 10 | **Warranty and Performance Guarantee** | General warranty statements and conditions for the membrane warranty. |


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## APPPENDICES:

**Appendix A** Drawings and Bill of Materials
**Appendix B** Packing Slip
**Appendix C** Testing Checklists / Pre-commissioning Test Checklist
**Appendix D** Spare Parts List
**Appendix E** Technical Specs and Brochures for Parts and Equipment
**Appendix F** Material Safety Data Sheets
**Appendix G** Glossary & Terms
**Appendix H** Biological Treatment & Monitoring Parameters
**Appendix I** Process and Chemicals Dosage Calculations
**Appendix J** Membrane Fouling
**Appendix K** newterra MicroClear™ Membrane Cleaning Log Sheet
**Appendix L** Alarms Troubleshooting Guide
**Appendix M** Process Troubleshooting Guide


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## 1.0 INTRODUCTION

The purpose of this manual is to provide necessary information for the Installation, Operation and Maintenance of the Waste Water Treatment Plant equipment.

| | |
|---|---|
|   | **The newterra MicroClear™ MBR wastewater treatment plant (WWTP) functions optimally if the operating procedures described in this manual are followed. If you have any questions after reading through this manual, please contact newterra ltd.** |

- This O&M Manual must be kept on-site and available to employees at all time.
- It is IMPERATIVE that employees read the manual BEFORE working in the plant.
- Employees' must read ***Section 2*** – Health and Safety.
- Technical Support Department contacts are provided in ***Section 9***.



***CAUTION:*** ***Once wetted, the membrane should remain wet, and not be allowed to dry out, to prevent irreversible damage to the membrane.***



***WARNING:*** ***Failure to comply with the instructions provided in this manual can cause equipment & property damage or severe personal injury, and will render the warranty null and void.***


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# 2.0 SAFETY

## 2.1 Introduction

This section provides general personal and environmental safety information for newterra MBR WWTP operators.

***Always refer to local codes and regulations.***

Specific equipment and parts safety information can be found in Appendix E. Material Safety Data Sheets (MSDSs) include detailed information regarding health & safety of chemicals used in wastewater treatment process and are presented in Appendix F.

Information and guidelines outlined in this manual **must** be followed at all times prior to system installation and during operation and maintenance.

### ESSENTIAL FOR SAFE OPERATION:

1. Installation and operation of the newterra MBR WWTP **must** only be carried out by **trained and qualified** personnel.
2. All necessary **safety precautions must** be carefully exercised, including but not limited to proper use of personal protective equipment considering given working environment and conditions.
3. All **electrical installations and troubleshooting must** only be carried out by licensed electricians.
4. All **plumbing work must** only be carried out by licensed plumbers or qualified personnel.
5. Please keep in mind that trees and shrubs taller than two meters located in close proximity to the plant buildings may become a safety concern at the time of installation or service.

### DEFINITION OF SAFETY AND WARNING SIGNS USED IN THE MANUAL




**ATTENTION SYMBOL**

Special attention is required to ensure compliance with instructions concerning correct operating sequences to prevent damage to the plant or its function.


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**GENERAL WARNING SIGN**

This symbol accompanies all important instructions or warnings associated with risks of injury as well as possible equipment damage.



**WARNING**

**CRITICAL WARNING SIGN**

Warns against an unsafe situation or practice associated with severe injury as well as major equipment damage.

### 2.1 Personal Protective Equipment (PPE)

Personal protective equipment refers to protective clothing, helmets, goggles, or other garments used to prevent injury.

The following list includes the minimum scope of PPE that should be available to newterra MBR WWTP operators:

**Eye and Face Protection:**

Protective glasses, goggles and face shields prevent wastewater and chemical splashes, tiny dust particles and vapors from getting in eyes and face.

**Foot Protection:**

Each operator should wear safety boots with steel toe and shank inserts at all times in wastewater plant operating area to protect feet from falling /rolling objects, wastewater and chemicals splashes, and electrical hazards.

**Hand Protection:**

Wear protective gloves at all times working in wastewater plant operating area; chemical-resistant gloves must be worn when handling chemicals


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**Clothing**

Wear protective clothing to minimize risk of biohazards. Chemical splash apron must be worn when operator handles chemicals.

## 2.2 Bacterial Safety

The wastewater contains a mixture of viable bacteria and other biological organisms. A wastewater treatment plant poses a number of bacterial hazards and consequently potential health risk. Immunization protects operator against infection. The use of proper hygiene measures, protective equipment, good housekeeping and common sense prevent contact with pathogens.

**These measures prevent infection!**



**Ensure that hands are washed with an antibacterial soap and warm water and dried by disposable towels on a regular basis, especially prior eating!**

**Do not expose cuts or open sores to wastewater!**

**Use personal protective equipment (PPE) at all times in wastewater treatment facility!**

**Any concern about possible infection should be brought to the attention of medical physician immediately!**

## 2.3 Chemical Safety

The following chemicals are used in operation of newterra MBR WWTP:

- **Sodium hydroxide (NaOH)** is used for pH adjustment, in case there is a deficiency in alkalinity in influent sewage and pH drops. It is very corrosive and hazardous in case of skin/ eye contact, and ingestion.

- **Sodium hypochlorite (NaOCl)** and **Citric Acid ($C_6H_8O_7$)** are used for cleaning the membranes.

  √ **Sodium hypochlorite (NaOCl)** is a common disinfectant, which can be an irritant or corrosive, depending on its concentration. It cannot be mixed with organics, ammonia compounds or acids. ***Contact with acids produces highly toxic chlorine gas. It has to be mixed only with pure water.***

  √ **Citric Acid ($C_6H_8O_7$)** is hazardous in case of skin contact (irritant, sensitizer), or ingestion, eye contact (irritant) and inhalation (lung irritant).


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When handling chemicals, it is important to wear proper personal protective equipment such as chemical goggles with combination full face shield, protective clothing with chemical splash apron and chemical-resistant rubber gloves.



***The detailed information regarding health & safety of chemicals used in wastewater treatment process can be found in MSDSs presented in Appendix F of the O&M Manual Material.***

### 2.4 Locking out Equipment

Lockout procedures must be followed prior to performing mechanical or electrical maintenance to ensure that equipment has been de-energized.

- All relevant local guidelines and procedures must be applied

### 2.5 Entering Confined Spaces

**Confined space** is defined as an area which is enclosed with limited access. The confined space:

- is large enough and so configured that an employee's body can enter and perform assigned work;
- has limited or restricted means for entry or exit; and
- is not designed for continuous employee occupancy;
- the accumulation of hazardous or toxic gases, vapor, dust, fumes, or the creation of an oxygen-deficient atmosphere may occur in confined space.

**Follow local laws and regulations with respect to entering a confined space.**

### 2.6 Vision Hazard

An Ultraviolet light (UV) unit is used in the wastewater treatment plant for final disinfection of treated effluent. Do not look directly at the blue UV lamps. Immediate or prolonged exposure to UV light can result in painful eye injury and skin burn.


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## 2.7 Responsibility for Safety

**Management:**

Management is responsible for providing a safe working environment. This is accomplished partly by:

- Ensuring that all facilities and equipment are built and maintained in accordance with the appropriate safety standards
- Providing adequate funds for equipment and plant maintenance
- Establishing, promoting, and enforcing a ***safety policy***
- Establishing a safety training program
- Supplying easy accessible eyewash and first-aid stations and proper personal protective equipment (PPE) for personnel servicing wastewater treatment facility.

**Worker:**

- To develop a positive and professional attitude towards safety.
- To avoid mistakes caused by indifference to safety, poor work habits, lack of attentiveness, rushing the job, failure to observe established safety procedures and poor physical condition.




***Remember the "ABC" of accident prevention*:**

**ALWAYS BE CAREFUL!!!**

In addition to ***"being careful"*,** it is the responsibility of all workers to:

- Work in accordance with established safety procedures
- Follow the established safety rules
- Wear appropriate personal protective equipment (PPE)
- Report all accidents, no matter how minor
- Report potential safety hazards
- Participate in safety programs


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## Plant Safety – Simple Rules to Follow




**Common sense plays a very important part in the safe operation of any type of plant!**

- Wear the appropriate personal protective equipment at all times.
- Keep walkways clear of snow and ice, and loose objects such as pails, shovels, tools, etc.
- Clean up spills of oil, grease, chemicals, or other substances immediately.
- Keep all tools and similar equipment clean, in good condition, and properly stored when not in use.
- Replace all manhole covers, access trap doors, etc. as soon as possible. Erect a safety barrier if it is necessary to leave the opening uncovered.
- Use the proper tools when removing or replacing a manhole cover.
- Wear a safety belt whenever there is the possibility of falling even a short distance, or when working over water.
- Lock out and tag electrical equipment before working on it or the associated equipment.
- Ensure that moving machinery is properly guarded. Wear ear protection in noisy environments.
- Ensure that fire-fighting equipment is in good working condition.


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## Hazard Warning Signs/Symbols





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## 3.0 WASTEWATER TREATMENT PLANT DESIGN BASIS

The **newterra** MBR Wastewater Treatment Plants (WWTPs) are designed for treatment of domestic wastewater from 200-m Mine Site camp with an average design flow of 72 $m^3$/d and 175-m Milne Port camp with an average design flow of 63 $m^3$/d. The wastewater treatment plants have been designed to meet the required effluent quality.

### newterra MicroClear™ MBR Process Specification

| Parameters | Unit | Value | |
|---|---|---|---|
| | | Mine Site WWTP | Milne Port WWTP |
| **Design Hydraulic Load** | | | |
| Average Daily Flow ( ADF) | $m^3$/d | 72 | 63 |
| Selected Design Flow ($Q_h$) | $m^3$/h | 3 | 2.63 |
| **Organic Load** | | | |
| COD Load | [kgCOD/d] | 76.32 | 66.78 |
| BOD Load | [kgBOD/d] | 38.16 | 33.39 |
| TKN Load | [kgTKN/d] | 5.4 | 4.73 |
| TAN Load | [kgTAN/d] | 3.24 | 2.84 |
| TP Load | [kgTP/d] | 0.86 | 0.76 |
| TSS Load | [kgTSS/d] | 41 | 35.9 |
| **Process Tanks** | | | |
| **One (1) Equalization Tank** | | | |
| Effective volume | $m^3$ | 43.5 | 43.5 |
| Hydraulic Retention Time ($HRT_{EQ}$) | h | 14.5 | 16.5 |
| **One (1) Aeration Tank** | | | |
| Effective volume | $m^3$ | 48 | 48 |
| $HRT_{AEROBIC}$ | h | 16 | 18.3 |
| **Two (2) Membrane Tanks** | | | |
| Total Effective Volume | $m^3$ | 5.0 | 5.0 |
| $HRT_{MEMBRANE}$ | h | 1.7 | 1.9 |


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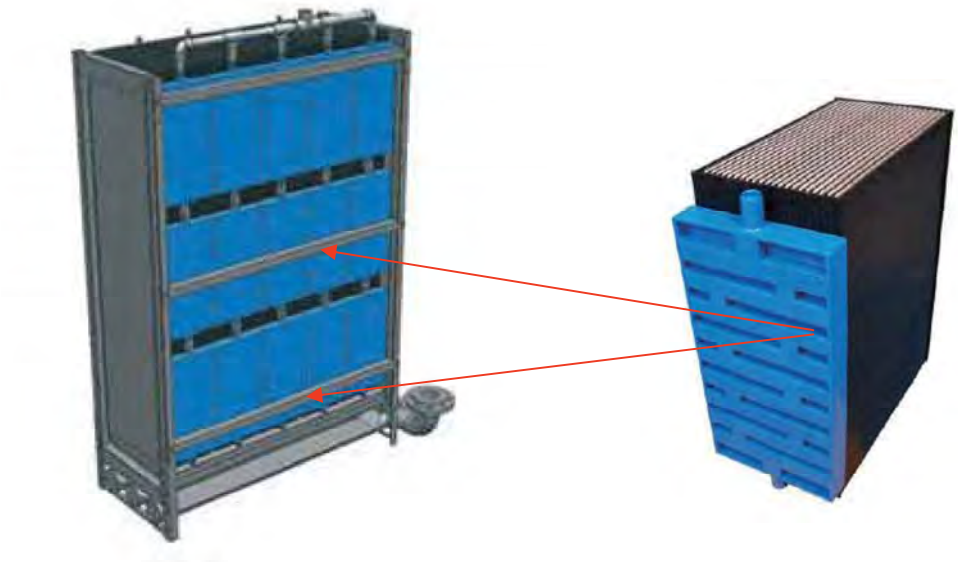
| Parameters | Unit | Value | |
|---|---|---|---|
| | | Mine Site WWTP | Milne Port WWTP |
| **MBR System (including aeration tank and membrane tanks)** | | | |
| Overall Effective Volume | $m^3$ | 53 | |
| Overall HRT | h | 17.7 | 20.2 |
| Overall SRT | d | 15 | 16 |
| Internal recirculation rate: Membrane tanks →Aeration tank | | 4 – 5x influent flow | |
| Average Design Flux | LMH | 18 | |
| Sludge wasting rate (at 1%, 10 g/L) | $m^3/d$ | 3.8 | 2.93 |
| Minimum / maximum design operating temperature | °C | 10 / 35 | |

| **MicroClear™ MB3-1 membrane module** | | |
|---|---|---|
| MCXL cassettes in each MB3-1 module | nr | 15 |
| Individual MB3-1 module filtration area | $m^2$ | 105 |
| MB3-1 modules in each membrane tank | nr | 1 |
| Total Membrane Filtration Area in two (2) membrane tanks | $m^2$ | 210 |
| MB3-1 Module Dimensions (L x W x H) | m | 1.30 x 0.70 x 1.85 |
| Housing materials | - | Stainless steel 1.4571 (316 Ti) |

| **Sludge Treatment System** | **Unit** | **Value** |
|---|---|---|
| **One (1) Mixing Tank** | | |
| Effective Volume | $m^3$ (gal) | 0.9 (240) |
| **One (1) 6 $ft^3$ (expandable to 10 $ft^3$) 630 mm filter press** | | |
| Feed from aeration tank | | |
| Sludge volume | $m^3$ | 2.93 |
| Sludge concentration | % | 1 |
| Dewatered sludge dryness | % | 25 |
| Filter press daily run time | | |
| Cycles | c/day | 4 |
| Cycle duration | h | 4 |
| Overall daily run time | h | 16 |
| Construction materials | - | Heavy duty steel skeleton, panted with two part epoxy |
| Polymer consumption (40 mg/L addition ratio of polymer at 0.25%) | L/d | 150 |


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**MicroClear™ MB3-1 membrane module**

**MicroClear™ MCXL membrane cassette**

**Influent Wastewater/Treated Effluent Characteristics:**

| Parameters | Unit | Influent Quality | Effluent Quality | |
|---|---|---|---|---|
| | | | Mine Site WWTP | Milne Port WWTP |
| pH | s.u. | 6.0 – 9.0 | 6.0 – 9.5 | 6.0 – 9.5 |
| Turbidity | NTU | | <5 | < 5 |
| Fat, Oil, Grease (FOG) | mg/L | < 30 | No visible seen | No visible seen |
| Chemical Oxygen Demand (COD) | mg/L | 1060 | - | - |
| Biological Oxygen Demand ($BOD_5$) | mg/L | 530 | < 10 | < 20 |
| Total Suspended Solids (TSS) | mg/L | 570 | < 10 | < 20 |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 75 | | - |
| Ammonia Nitrogen ($NH_3$-N) | mg/L | 45 | < 2 | < 2 |
| Total Phosphorus (TP) | mg/L | 12 | < 0.1 | - |
| E-Coli / Fecal Coliform | CFU/100 mL | | < 200* | < 200* |
| Alkalinity (assumed) | mg/L as $CaCO_3$ | 10 – 14 | - | - |

**After UV disinfection*


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## Prohibited Items

The raw wastewater should not contain any of the following substances:

- Hydrocarbons – lubricants, gasoline, diesel, etc.;
- Paints, solvents, silica, silicones and polymers;
- Antibacterial solutions, and products with quaternary ammonia;
- Large quantities of chemicals such as water softener, disinfectants, strong acids & alkalis, pesticides or photographic chemicals;
- Silicone based defoamers;
- Non-biodegradable solid waste (plastic, rubber products, disposable diapers, etc.);
- High amount of metals, such as iron, magnesium, calcium, barium and strontium.



**TOXIC MATERIALS SHOULD NOT BE THROWN INTO THE DRAIN!**

The raw wastewater should also comply with the following compatibility chart. The lipophilic substances concentration must be lower than **50 mg/L.**

## MicroClear™ Membrane Compatibility Chart

| Group | Substances | SP-Type Membrane |
|---|---|---|
| Chlorinated solvents | Methylene Chloride, Chloroform, Carbon Tetrachloride, Chlorobezene, Trichloroethane (<1%) | -- |
| Esters | Ethyl Acetate, Butyl Acetate, Butyl Acrylate (<1%) | -- |
| Ethers | Ethyl Ether, Polyethylene Oxide (<1%) | -- |
| $H_2O_2$ | <2000 ppm | ++ |
| Inorganic acids | HF, HCl, $H_2SO_4$ | pH 0 - 14 |
| Ketones | Acetone, Methyl Ethyl Ketone | -- |
| NaOCl | 100,000 ppmxh | ++ |


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| | | |
|---|---|---|
| Organic acids | Sulfamic Acid, Formic Acid, Oleic Acid, Sulfonic Acid, Acetic Acid, Acrylic Acid, Latic Acid | pH 0 - 14 |
| Phenols | | -- |
| Silicones | | -- |
| Alcohols | Ethanol, Butanol, Isopropranol (<50%) | + |
| Aldehydes | Formaldehyde (<1%) | ++ |
| Alkali | | pH 0 - 14 |
| | Dimethyl Formamide, Dimethyl, Acetamid Dioxane, N-Methyl, Pyrrolidone, Tetramethyl Acetamide | -- |
| Aprotic Solvents | Benzene, Toluene, Xylene, Anthracene, Naphatalene, Gasoline | -- |
| Aromatic hydrocarbon | Methoxyethanol, Ethoxyethanol, Buthoxyethanol | ? |

**(++ = Very good, + = good, - = fair, -- = not recommended)**

## Removal of Oily Materials

The wastewater must pass through a grease trap (or similar facility for grease/fat removal), if there is kitchen usage onsite. The large amount of oil and fat can harm treatment facility (e.g., clogging pumps and piping and cause foaming in the aeration tank). To avoid premature membrane fouling, maximum FOG concentrations should not exceed 30 mg/L.




**Fats, oils and grease (FOG) must be removed prior to MBR. Removing of FOG significantly reduces membrane fouling, foaming potential and increases aeration efficiency.**


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## 4.0 PLANT INSTALLATION, INSPECTION, AND TESTING

The **newterra** MicroClear™ MBR WWTP is a packaged plant which comes complete with containerized inlet screen, equalization tank, post EQ screen, aeration tank, membrane tanks, UV disinfection systems and a sludge dewatering unit. The plant is housed inside multiple 40-ft modified high-cube shipping containers - completely pre-assembled, pre-piped, pre-wired and pre-tested, ready for a quick site installation and start-up. The standard containerized design also allows for modular expandability, portability and quick deployment, particularly beneficial features for work camp applications.

### 4.1 Site Conditions Requirements

- Installation site for the **newterra** MicroClear™ MBR WWTP should be close to the sewer drain and have a sufficient power source (refer to Electrical Drawings in **Appendix A** of this manual).

- Location must permit easy access for equipment capable of transporting, offloading, and handling of the designed loads.

- There should be adequate space around the containers for safe operation and maintenance.

- The firm base (foundation) must be built to support the full operating weight of the plant to prevent buildings from shifting and pipe/electrical conduit connection failure – pilings or rig mats are recommended (based on site conditions).




**The firm base for the container must be level and must be capable of supporting the operating weight.**



**WARNING:** ***Always check with the local utility companies for the location of water lines, electrical and telephone cables, or any additional hazards below grade, prior to excavation. Failure to do so could result in severe bodily injury or death.***


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### 4.2 Inspection upon Delivery

The **newterra** MicroClear™ MBR WWTP is carefully manufactured, checked, and tested at the manufacturing plant. All equipment is pre-wired, pre-piped, mounted inside the enclosure and factory tested. Upon receiving the system, please perform the following:

- Place the containers onto the prepared firm base to avoid sagging, equipment vibration, and shifting. When lifting the container, ensure that lifting equipment is clear of overhead obstructions such as power lines, trees or rooftops. Be careful during this procedure!
- Be careful when offloading the containers to prevent damage to the internal pipe work.
- Check the containers for any signs of shipping damages.
- Inspect the containers to ensure that no components or parts are missing (refer to the **Packing Slip** presented in **Appendix B** of this manual). Also, inspect for visual damage of the tanks, pumps, blowers, piping, and control panel.
- If the containers, equipment inside and any parts shipped loose are free of damage, proceed with the installation.

For any damages or loss of equipment, **please notify newterra ltd. at (800) 420-4056 immediately.**

### 4.3 Plant Initial Set up

**WARNING:** ***The installer must ensure that the installation site is safe from hazards. These could include excavations left open overnight, debris left lying around, and tanks & equipment not properly blocked. Provisions must be made to eliminate the potential hazards by roping off and proper shoring around the excavations, cleaning up at the end of each workday, and proper storage of equipment. Failure to do so could result in severe injury or death.***


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## Enclosures Specifications

| | |
|---|---|
| **WWTP Enclosures** | newterra MicroClear™ MBR WWTP consists of six (6) cMET certified, built to NEC standard enclosures |
| **Enclosure #1** (SCREEN BLD-7903) | Room #1 - Class 1 Div 2, contains Screen Modules with Screw Screen Compactors (SCR-201/SCR-401), Screen Discharge Tanks (TNK-202/TNK-401), and pumps |
| | Room #2 - General Purpose (GP), contains Control Panel |
| **Enclosure #2** (EQUALIZATION BLD-7901) | General Purpose (GP), contains Equalization Tank (TNK-301) |
| **Enclosure #3** (AERATION BLD-7902) | General Purpose (GP), contains Aeration Tank (TNK-501) |
| **Enclosure #4** (MBR FILTRATION BLD-7900) | General Purpose (GP), contains Membrane Tanks (TNK-601/TNK-602), scouring blowers, pumps, permeate withdrawal systems, UV system, and chemical units |
| **Enclosure #5** (EFFLUENT BLD-7905) | General Purpose (GP), contains Effluent Tanks (TNK-811/TNK-812/TNK-813/TNK-814), pumps, and chemical units |
| **Enclosure #6** (SLUDGE BLD-7904) | Room #1 - Class 1 Div 2, contains sludge dewatering module including Filter Press (FP=901), mixing tank (TNK-901), air , and pumps |
| | Room #2 - General Purpose (GP), contains pumps and blowers for aeration tank, and office space |
| **Estimated Dry shipping weight for each enclosure** | SCREEN BLD-7903 – 20 000 lb (9072 kg)<br>EQUALIZATION BLD-7901 – 26 000 lb (11 793 kg)<br>AERATION BLD-7902 – 28 000 lb (12 700 kg)<br>MBR FILTRATION BLD-7900 - 23 000 lb (10 432 kg)<br>EFFLUENT BLD-7905 - 15 000 lb (6804 kg)<br>SLUDGE BLD-7904 – 20 000 lb (9072 kg) |
| **Enclosures Dimensions** | All enclosures are 40-ft high-cube modified shipping containers: 12.2 m L x 2.44 m W x 2.89 m H (40' L x 8' W x 9'6" H) |
| **Influent supplied head** | 3.0 m (10') |
| **Treated effluent discharged head pressure** | 1.5 m (5') |
| **Inlet pipes** | 3" steel FNPT for wastewater from lift station; 3" steel with female camlock from sewage truck |
| **Discharge pipe** | 2" steel pipe with 2" flange |


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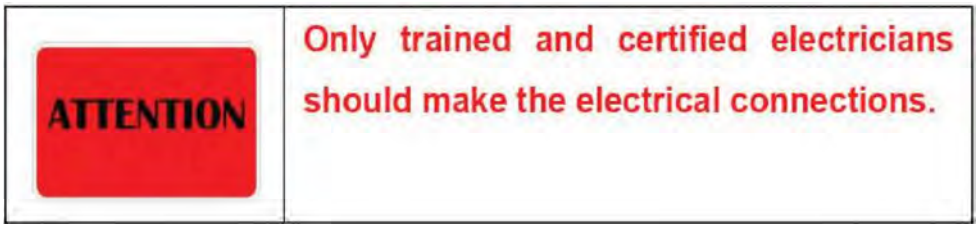
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Verify site power per system design criteria.

**System Electrical Specifications:**

| | |
|---|---|
| System Power | 600-V, 3-Phase, 3-Wire, 60 Hz |
| Main Disconnect | 200 A |
| Panel Approval and Classification | cMET, Classified |
| System Approval and Classification | cMET, Classified GP & C1 Div 2 |
| Telemetry Setup | - |

**Please refer to the as-built electrical drawings in Appendix A of this manual.**




**Installation Instructions:**

1. Remove hatch covers from the interconnecting ports.
2. Place containers tight against each other with the interconnecting ports lining up.
3. Connect electrical power to the **Main Switch Panel** located inside the enclosure **(BLD-CONTROL)** 3 phase, 380 V from available source ensuring correct phase rotation.
4. Ensure that proper electrical grounding and lightning protection is available.
5. Switch **Main Switch Panel's isolator** to the **ON** position.
6. Check all internal lighting, heating, and ventilation for correct operation.
7. Install packed external lighting into brackets above the doorway (double man doors), route the cables to the inside of the container through the ports provided and plug into sockets provided (check for correct operation).


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8. Ensure that a potable water supply is available (used for hydraulic testing during start-up, membrane cleaning, washing hands and for performing onsite testing).

9. **Ensure availability of an emergency eyewash station and personal protection equipment onsite.**

10. Verify membrane modules are secured within the membrane tanks – i.e. verify wheel chocks (if applicable) are in the correct location and that there is no lateral movement (less than an inch) of the membrane modules on the wheel tracks in the tanks.

## 4.4 Plant Initial Testing

The **newterra** MBR WWTP (except the membrane modules) undergoes electrical and leakage tests in our manufacturing facility prior to shipment; however, fittings could shift during shipment, so it is our standard practice to perform plant initial testing including **dry and hydraulic tests.**

### 4.4.1 Dry Test

The following tasks have to be performed **before potable water** is introduced into the system:

- Ensure that all tanks are clean and free of any dirt or debris (this is to prevent obstruction or damage to the piping, pumps, and membranes).
- Ensure that all connections have been provided and joints have been tightened.
- Check the placement of the air diffusers in the equalization tank **(TNK-301)** and aeration tank **(TNK-501)** if incorrectly positioned, proper adjustment has to be performed.
- Ensure that a functional check of the electrical and control system has been performed (please refer to the **newterra Pre-commissioning Test Checklist** presented in **Appendix C**).

### 4.4.2 Hydraulic Test

The hydraulic test is performed using potable water to:

- Check for and fix any leakage;
- Check the setting of level switches/transmitters;
- Check the hydraulic flow through the plant;


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- Check if all the ancillary equipment and controls of the plant function as per design;
- Recalibrate instruments (if applicable);
- Perform clean water test on membranes.



**Caution: Once wetted, the membrane should remain wet, and not be allowed to dry out to prevent irreversible damage to the membrane.**

## Performing the Hydraulic Test

- Fill the system [equalization tank (TNK-301) and aeration tank (TNK-501)] with potable water, run the pumps and check for any signs of leakage.
- Perform electrical and instrumentation (E&I) functional checks and adjustment of level switches.
- Turn on the air blowers B-301/B-302/B-303/B-304/B-305/B-306 for the equalization tank (TNK-301) and blowers B-501/B-502 for the aeration tank (TNK-501), and check for:
    - Buoyancy of air diffusers and if this occurs, empty the tank and fix;
    - Air leakages: if this occurs, tighten up the fittings;
    - Manually check water temperature and DO (dissolved oxygen): with a hand-held DO meter and adjust air flow to keep it up to 0.5 – 1 mg/L for equalization tank (TNK-301) and 2- 3 mg/L for aeration tank (TNK-501); check the DO readings on the touch screen.
    - DO Control System: check automatic ON/OFF of aeration tank air blowers at low and high settings of DO without the return of aerated water from the membrane tanks to aeration tank, and record blower ON/OFF duration.

## Membrane Tanks (TNK-601/TKN-602):

- Enable membrane operation.
- Start the pumps (P-501/P-502) for aeration tank and fill the membrane tank (TNK-601) with potable water.
- Start the air blowers (B-601/B-602/B-603/B-604/B-605) for membrane tank (TNK-601) and blowers (B-606/B-607/B-608/B-609/B-610)for membrane tank (TNK-602) and check for an even distribution of air across the membrane filter area and air bubble uniformity above the membrane modules/cassettes.


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- Check hydraulic flow pattern through the membranes and between membrane modules/ cassettes and tank wall.
- Make a clean copy of the **Clean Water Testing Sheet** presented in **Appendix K** of this O&M Manual.
- Start the permeate (vacuum) pumps P-701/P-702
- Record all checked parameters in the **Clean Water Testing Sheet:**
    - Record the vacuum (TMP) on gauges PI-701/PI-702 [for clean water could be 0.05 to 0.07 bar (20" to 29" WC)].
    - Record ambient temperature, and water temperature and DO with a hand-held DO meter.
    - Gradually increase the permeate flow while recording the vacuum (TMP) on the gauges up to the anticipated peak wastewater flow.
- Forward a complete **Clean Water Testing Sheet** to **newterra** for analysis.


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## 5.0 OPERATION of newterra MicroClear™ MBR

Membrane Bioreactor (MBR) treatment technology is an effective combination of an activated sludge biological treatment process with MicroClear™ MBR membrane filtration technology. The MBR operates at MLSS (mixed liquor suspended solids) concentrations between 8,000 to 12,000 mg/L.

This section provides a brief description of the treatment process and how it is controlled. Most of the equipment in the **newterra** WWTP can be operated in either manual or automatic mode. The system is designed to always run in auto mode. The manual option is provided mainly for maintenance purposes. Equipment and instrumentation identification numbers are referenced from the **Process & Instrumentation Diagram** and **System Layout** presented in **Appendix A** of this O&M Manual.

### Automatic Operation

The PLC-based control system is the default operation mode for the **newterra** MicroClear™ MBR. The system operates as a programmable computer that:

- Receives analog and digital input signals from the switches and transmitters being controlled;
- Processes this information using the structure and rules entered into the program;
- Generates outputs that control the equipment - turn equipment **OFF** or **ON**.

Under normal operation, all switches are set in the **AUTO** position on the **HMI**.

All alarms are visually indicated on a beacon stack on the roof of the exterior of the container:

- Green – System OK
- Green Flashing – System Auto Restart
- Red Solid – Warning Alarm
- Red Flashing – Critical Alarm
- No Light – Loss of Power

The MBR will always remain in auto run mode, unless the kill switch is pressed or power is down. The MBR will automatically restart after power failure given that the system was running when the power failed.




**All high high level alarms (identified as LSHH on P&ID) indicate a critical situation for imminent tank overflow and could result in pump(s) shutting off to avoid overflow situations and requires immediate operator attention.**


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## Manual Operation

The manual mode of operation is provided for maintenance purposes and for emergency operation of the plant in the unlikely event of a failure of the automatic control system (default operation mode). Operators **must be present when equipment is operated in the manual mode.**

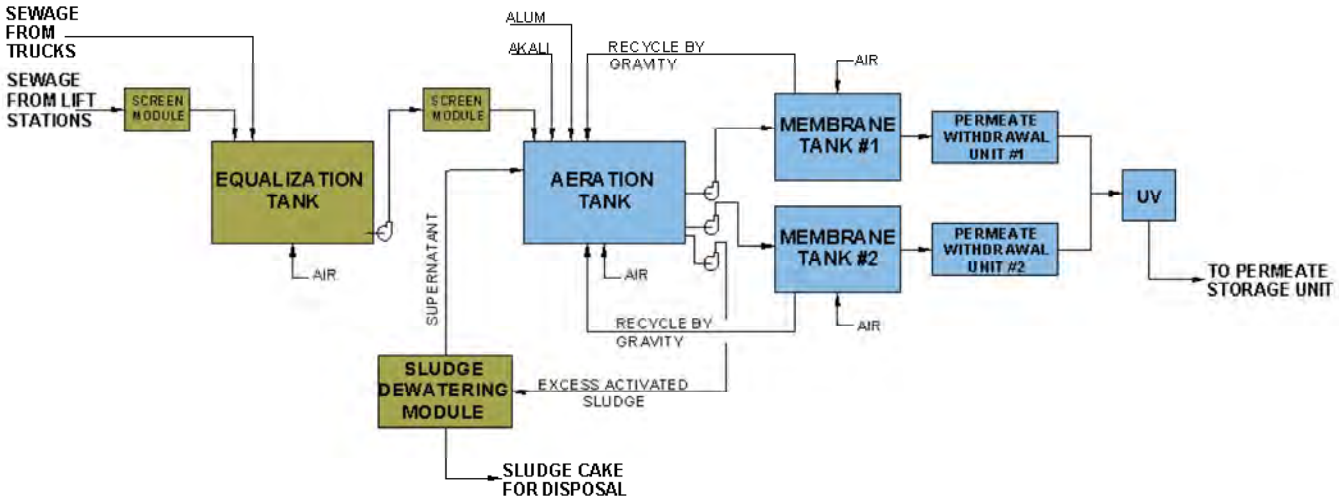
A HAND-OFF-AUTO (H-O-A) switch is provided on the touch screen of the control panel. The HAND position on the switch allows the equipment to be operated in the manual mode.




**For safety reasons, a motor in the HAND position will only run for two minutes before it will be automatically stopped.**

## 5.1 Wastewater Treatment Process Description / Control Narrative

The **newterra** MBR WWTP comprises screen modules, equalization tank, aeration tank, membrane filtration module, UV system, permeate storage tank, and sludge dewatering module.





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### 5.1.1 Buildings/ Utilities

The newterra MBR WWTP is housed inside six (6) enclosures (buildings):

- Screen building (BLD-7903) with two (2) rooms: Room #1 (Electrical Classification – Class 1, Div 2 area), and Room #2 (GP area)
- Equalization tank building (BLD-7901)
- Aeration building (BLD-7902), GP area
- Membrane Filtration building (BLD-7900), GP area
- Effluent building (BLD-7905), GP area
- Sludge building (BLD-7904) with two (2) rooms: Room #1 (Electrical Classification – Class 1 Div 2 area), and Office Room #2 (GP area)

The main control panel is located in the Screen building (BLD-7903), Room #2 (GP area)

#### 5.1.1.1 Wastewater Treatment Plant Power Supply




**Please refer to the as-built Electrical Block Diagram presented in Appendix A of this manual.**

A power monitor has been installed in the main power distribution panel to ensure proper power and phase rotation is delivered to the system. The main power distribution panel is located in the Screen BLD-7903, Room #2 (GP area).

**E-STOP**

There are several emergency stop buttons wired to a common system kill circuit (KILL-7901) in the plant:

- Kill Switch Emergency Stop **MCP-01** (ESD-8201) located in the control room of the BLD-7903, Room #2, (GP area)
- Emergency Stop **MCP-02** (ESD-8202) located in BLD-7900
- Emergency Stop **MCP-03** (ESD-8203) located in BLD-7905
- Emergency Stop **MCP-04** (ESD-8204) located in BLD-7904, Room #2 (GP area)
- Emergency Stop Screen (ESD-7931) located in BLD 7903, Room #1 1 (Class 1 Div 2 area)
- Emergency Stop Membrane Filtration (ESD-7911) located in BLD-7900

The following emergency stop switches are used for local shut off:

- Emergency Stop Effluent (ESD-7905) located in BLD-7905
- Emergency Stop Sludge (ESD-7941) located in BLD-7904


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### 5.1.1.2 SCREEN BLD-7903

**Ventilation**

Two (2) exhaust blowers (B-7931 & B-7932) provide constant ventilation for the Screen Modules and Building BLD-7903 Room #1 (Electrical Classification – Class 1 Div 2 area). The air from the blowers is passed through a heat recovery system prior to discharging outside. The blowers run at all times at a rate of ~12 air changes per hour to ensure the requirements of the electrically classified location are met.

**Alarms**

If the blowers' motors stop running an alarm signal will be sent to the PLC from current switches (YI-7931/ YI-7932).

A single exhaust fan (F-7911) is locate in the Room #2 (GP) of the BLD-7903 where the main control panel is located. The purpose of the fan is to prevent the building temperature from climbing higher than desired room set point temperature. The desired room temperature must be set by the operator with the building high temperature switch TSH-7911. If this switch is tripped the exhaust fan will run until the temperature drops below the set point.

**Note**: The fan (F-7911) is to be used primarily during the summer months - freezing cold air in to the building can lead to condensation/potential freezing risks for critical pieces of equipment.

**Hydrogen Sulphide Detection**

A Hydrogen Sulphide ($H_2S$) Detector (AIT-7931) is installed in the screen building (BLD-7903) Room #1 (Electrical Classification – Class 1 Div 2 area). This sensor allows continuous monitoring for $H_2S$ gas. In the event the $H_2S$ alarm level set point is exceeded an alarm will be triggered and indicated on the HMI, an internal and external audible buzzer will sound, the alarm beacon light will illuminate. The water treatment process will continue to run.

**Temperature control**

For building (BLD-7903), temperature is controlled manually at the local thermostats of the heaters: H-7931/H-7932 for the Room #1 (Electrical Classification - Class 1 Div 2) and H-7933 for the Room #2 (GP area). They are not linked to the PLC.

The operator is required to set the desired building temperature set point in $^{o}F$ at the temperature switches (TSL-7931 and TSL-7932) located in the general purpose room of this building. If the building temperature falls below the temperature switch setting the electric heaters (H-7931/H-7932) will turn on. H-7933 is locally controlled only.

**CAUTION: The temperature switch units are in $^{o}F$.**


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**Alarms**

If the temperature of the room #1 and room #2 in the BLD-7903 drops below the low low temperature set point, the alarm switches (TSLL-7931 & TSLL-7932) will trip and after 300 sec a low temperature alarm will register on the HMI and the red beacon light will illuminate. This may indicate that heaters (H-7931/H-7932) are faulty.

### 5.1.1.3 EQUALIZATION TANK BLD-7901

**Ventilation**

The Equalization Tank (TNK-301) is equipped with a ventilation exhaust blower (B-307) located in classified area of BLD-7903. The blower runs at all times providing constant ventilation of the equalization tank. The blower vents air at a rate of 12 air changes per hour and exhausts to the exterior of the building.

If the blower's motor stops running an alarm signal will be sent to the PLC from current indicator switch (YI-307).

### 5.1.1.4 AERATION TANK BLD-7902

**Ventilation**

The aeration tank head space is vented by a blower (B-503) to the aeration foam tank (see details in subsection 5.2.3).

### 5.1.1.5 MEMBRANE FILTRATION BLD-7900

**Hydrogen Sulphide Detection**

A Hydrogen Sulphide ($H_2S$) Detector (AIT-7911) is installed below the control panel in the permeate extraction system room of building 7900. This sensor allows continuous monitoring for $H_2S$ gas. In the event the $H_2S$ alarm level set point is exceeded an alarm will be triggered and indicated on the HMI, an internal and external audible buzzer will sound, the alarm beacon light will illuminate. The water treatment process will continue to run.

**Temperature control**

For building (BLD-7900), temperature is controlled manually at the local thermostats for the wall mounted heaters: H-7911/H-7912. They are not linked to the PLC.

The operator is required to set the desired building temperature set point in $^{o}F$ at the temperature switch (TSL-7912). If the building temperature falls below the temperature switch setting the wall mounted electric heaters (H-7911/H-7912) will turn on.

**CAUTION: The temperature switch units are in $^{o}F$.**


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**Alarms**

If the temperature in the BLD-7900 drops below the low low temperature set point, the alarm switch (TSLL-7901/TSLL-7905) will trip and after 60 sec the room's temperature alarm will register on the HMI and the red beacon light will illuminate. This may indicate that heaters (H-7911/H-7912) are faulty.

### 5.1.1.6 EFFLUENT STORAGE BLD-7905

**Temperature control**

For BLD-7905, temperature is controlled manually at the local thermostat for the wall mounted heaters (H-7951/H-7952). They are not linked to the PLC.

The operator is required to set the desired building temperature set point in $^{o}$F at the temperature switch (TSL-7952). If the building temperature falls below the temperature switch setting the wall mounted electric heaters (H-7951/H-7952) will turn on.

**CAUTION: The temperature switch units are in $^{o}$F.**

**Alarms**

If the temperature in the BLD-7905 drops below the low low temperature set point, the alarm switch (TSLL-7951) will trip and after 60 sec a building temperature alarm will register on the HMI and the red beacon light will illuminate. This may indicate that heaters (H-7951/H-7952) are faulty.

### 5.1.1.6 SLUDGE BLD-7904

**Ventilation**

Building (BLD-7904), Room #1, Class 1 Div 2 is equipped with an exhaust blower (B-7941). The blower runs at all times providing constant ventilation of the room. The blower vents air at a rate of 12 air changes per hour. The air from the blower (B-7941) is passed through a heat recovery system prior to discharging outside the BLD-7904.

If the blower's motor stops running an alarm signal will be sent to the PLC from current (YI-7941).

**Temperature control**

For BLD-7904, temperature is controlled manually at the local thermostats for the wall mounted heaters: H-7941/H-7942 for the Room #1, Class 1 Div 2 and H-7943 for the Room #2 General Purpose. They are not linked to the PLC. There are temperature switches in the BLD-7904: TSL-7941/TSL-7942 for the Room #1 (Class 1 Div 2).


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**Alarm**

Alarm switch (TSLL-7941) is activated when the temperature falls below set point. This may indicate that heaters (H-7941/H-7942) are faulty.

**Compressed air**

Air compressor (C-901) supplies air to operate the filter press (FP-901). The air compressor has level switches:

- an oil level switch alarm (LSLL-901) is activated when the oil level is low
- if pressure switch (PSL-901) is activated an alarm will register on the HMI indicating the air compressor has malfunctioned.

### 5.1.1.7 FIRE AND EXPLOSION PROTECTION

There are some areas in the plant defined as Class 1 Div 2 according to the National Electrical Code Classification (NFPA 70). These areas are:

- Screen building (BLD-7903), Room #1
- Equalization tank zone, (BLD-7901)
- Sludge building (BLD-7904), Room #1

This classification refers to the areas with potential hazards as flammable gas which is not present under normal conditions.

Fire alarm system is implemented across the plant. The fire protection measures include fire alarm system (FAS), fire detection system (FDS), and portable fire extinguishers. Please refer to the Fire Alarm Layout Drawing presented in Appendix A of this manual.

## 5.1.2 Process Description

### 5.1.2.1 Screen Modules Building (SCREEN BLD-7903)

***Function***: a screening process is provided to remove hair, and fibrous materials from wastewater supplied from the lift stations and delivered by sewage trucks.

There are two (2) screen systems in the plant:

- screen module (SCR-201) for screening incoming raw sewage pumped from lift stations
- screen module (SCR-401) for screening effluent from equalization tank (TNK-301) taking into account addition of raw sewage delivered by sewage trucks and added into the equalization tank (TNK-301)

Both screen modules are located in the building (BLD-7903), Room #1 (Class 1 Div 2 area).


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## Screw Screen Compactor (SCR-201)/Screen Tank

The screw screen compactor module consists of:

- screw screen compactor with 2-mm opening, equipped with solids bagging
- discharge tank (TNK-202) for collection of the screened wastewater
- external discharge pumps (P-201/P-202) to transfer screened wastewater to the equalization tank (TNK-301)
- self cleaning spray nozzles set on a timer through the HMI

### Screw Screen Basin Level Control

The screw screen (SCR-201) will run when the permissive signal (YC-101) to receive from the lift station is ON, and the high level in the screen tank has been reached. If the high level in the screw screen basin has been reached this indicates the screen is clogged. The screw will continue to turn for 2 minutes after the high level condition has cleared.

Screened wastewater flows by gravity from screw screen basin to the screen discharge tank (TNK-202) through 6" discharge pipe.

#### *Alarms*

If the clogged screen cannot be cleared and the high high level in the screw screen basin is reached the LSHH-201 will trip. If the LSHH-201 level switch is tripped, an alarm will be generated and will remain visible on the HMI until the alarm condition has cleared. The permissive to receive wastewater from the lift station will be lost. **Operator intervention is required in the event of this alarm!**

In the event the SCR-201 motor trips off on overload an alarm will register on the HMI and the red beacon light will flash.

### Screen Tank Level Control:

The screen discharge tank (TNK-202) is equipped with:

- (2) external discharge pumps (P-201 Duty and P-202 Standby)
- discharge pressure indicator (PI-201/ PI-202) to measure the discharge pressure
- motor current switch (YA-201 /YA-202)
- variable frequency drive (VFD-201/VFD-202)
- discharge tank (TNK-202) is equipped with level transmitter (LT-202) and high high level switch (LSHH-202)

After completion of 4 cycles the standby pump will run for 1 cycle. Each time a pump starts the cycle count goes up. As long as the wastewater level in TNK-202 is between the high and low set point, the PLC will allow the operation of the pumps (P-201/P-202) to transfer wastewater to the equalization tank (TNK-301).The VFD's regulate the flow of the pumps to keep the discharge flow rate at the desired set point flow.


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If current switches (YA-201/YA-202) are ON and level transmitter (LT-202) indicates the high set point, then the pumps turn on until the level transmitter (LT-202) gets to its low set point.

If the high level set point is on for more than 5 seconds, pumps (P-201/P-202) will increase speed to clear the high level condition.

**Alarms**

In the event the screen tank discharge pumps motor current switches (YA-201/YA-202) trip, an alarm will register on the HMI and the red beacon light will flash.

**Screen Cleaning:**

A potable water connection to the screw screen compactor unit (SCR-201) is used to clean the screw screen. A solenoid valve (SV-201) is controlled on a timer to open the solenoid valve for 2 seconds every 60 minutes, with the goal of removing solid build up on the screw screen. Frequency of cycle can be changed through the HMI.

### 5.1.2.2 Equalization Tank (TNK-301)

***Function***: Buffers influent variable flow to prevent concentration fluctuations in (i.e. BOD, TSS etc.) through the MBR treatment system.

The equalization tank (TNK-301) receives screened wastewater from the screen tank (TNK-202). The equalization tank (TNK-301) can also receive raw wastewater from the sewage trucks. There are two truck hook-ups from the screen building (BLD-7903) side equipped with 3" female camlocks, valves and 3" PVC pipes.

**WARNING: NO CONTROLS ARE IN PLACE TO SHUT OFF TRUCK INFLUENT TO THE EQUALIZATION TANK IN THE EVENT OF A HIGH OR HIGH HIGH LEVEL CONDITION IN THE EQUALIZATION TANK. THE LEVEL OF THE EQ TANK MUST BE MANUALLY MONITORED AT ALL TIMES DURING THE OFFLOADING OF TRUCKS.**

The effective volume of the EQ tank is 43.5 $m^3$, providing a hydraulic retention time of 14.5 hours. The equalization tank is equipped with:

- level monitoring/control equipment
- 2 electric immersion heaters with local temperature control
- blowers (B-301to B-306) supply air to the air diffusers
- 10 EDI fine-bubble air diffusers for mixing and assisting the elimination of potential odour
- 12 magnesium anodes which act as the tank ground and will be sacrificially eroded as a means of prolonging the tank life
- discharge pumps (P-301/ P-302) for transferring wastewater to the SCR-401


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## Air Diffusers Control

Blowers (B-301- B-306) supply air to the air diffusers installed in the bottom of the equalization tank. A pressure indicator (PI-301) and switch (PLS-301) is installed on the discharge side of the blowers.

### Alarms

If the blower air pressure drops below set point, the low pressure switch (PLS-301) will trip and a low pressure alarm will be activated through the PLC. The flashing red beacon light will illuminate.

## Temperature Control

The equalization tank (TNK-301) is heated via 2 electric immersion heaters (H-301/H-302).Temperature in the tank is controlled via a local thermostat. Recommended temperature setting for TSL-301/TSL-302 is 10$^{o}$C to 15$^{o}$C.

### Alarms

If the Temperature Switch Low Low (TSLL-301) is tripped an alarm signal will register on the HMI and the flashing red beacon light will illuminate.

**Note**: As a low water level in the tank can cause damage to the heaters, the Level Switch Low Low (LSLL-301) is installed in the equalization tank to protect the immersion heaters and if tripped will shut the tank heaters off and initiate an alarm signal from the PLC.

## Transfer Pumps/Level Control

The equalization tank (TNK-301) has two (2) external pumps (P-301, P-302) with one of the pumps acting as a standby. Pump (P-301) operates for 4 cycles, pump (P-302) for 1. This pump transfers the wastewater from the equalization tank (TNK-301) to SCR-401 screw screen basin tank.

The equalization tank discharge pumps (P-301/P-302) have local pressure indicators (PI-302/PI-303) to measure discharge pressure and motor current switches (YI-301/YI-302). The discharge pressure can be used to determine an estimation of the flow rate based on the pump curve.

A level transmitter (LT-301) is used to indicate the liquor level in the equalization tank (TNK-301). As long as the level in the tank is above set point, the PLC will allow the operation of either EQ tank discharge pump (P-301 or P-302). If the high level in the EQ tank is met the screen tank supply pumps will be turned off.

### Alarms

In the event the equalization tank discharge pumps motor current switches (YI-401/YI-402) trip, an alarm will register on the HMI and the red beacon light will flash.


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The Level Switch High High (LSHH-301) if tripped will send a signal to the PLC to warn of imminent overflow in the equalization tank (TNK-301).

## Post EQ Screw Screen Compactor (SCR-401)

The screw screen compactor module consists of:

- screw screen compactor with 2-mm opening, equipped with solids bagging
- discharge tank (TNK-401) for collection of the screened wastewater
- external discharge pumps (P-401/P-402) to transfer screened wastewater to the aeration tank (TNK-501)
- self cleaning spray nozzles set on a timer through the HMI

### Screw Screen Basin Level Control

The screw screen (SCR-401) will run when the high level in the screen tank has been reached. If the high level in the screw screen basin has been reached this indicates the screen is clogged. The screw will continue to turn for 2 minutes after the high level condition has cleared.

Screened wastewater flows by gravity from screw screen basin to the screen discharge tank (TNK-401) through 6" discharge pipe.

#### *Alarms*

If the clogged screen cannot be cleared after 5 minutes a high high level alarm (LSHH-402) will be triggered and will remain visible on the HMI until the alarm condition has cleared. The permissive to receive wastewater from the equalization tank (TNK-301) will be lost. **Operator intervention is required in the event of this alarm!**

In the event the SCR-401 motor trips off on overload an alarm will register on the HMI and the red beacon light will flash.

### Screen Tank Level Control:

The screen discharge tank (TNK-401) is equipped with:

- (2) external discharge pumps (P-401 Duty and P-402 Standby)
- discharge pressure indicator (PI-401/ PI-402) to measure the discharge pressure
- motor current switch (YA-401 /YA-402)
- discharge tank (TNK-401) is equipped with a low level switch(LSL-402), high level switch (LSH-402) and a high high level switch (LSHH-202)

After completion of 4 cycles the standby pump will run for 1 cycle. Each time a pump starts the cycle count goes up. As long as the wastewater level in TNK-401 is above the low level switch level, the PLC will allow the operation of the discharge pumps (P-401/P-402) to transfer wastewater to the equalization tank (TNK-301).

#### *Alarms*

In the event the screen tank discharge pumps motor current switches (YA-201/YA-202) trip, an alarm will register on the HMI and the red beacon light will flash.


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**Screen Cleaning:**

A potable water connection to the screw screen compactor unit (SCR-401) is used to clean the screw screen. A solenoid valve (SV-401) is controlled on a timer to open the solenoid valve for 2 seconds every 60 minutes, with the goal of removing solid build up on the screw screen. Frequency of cycle can be changed through the HMI.

### 5.1.2.3 Aeration Tank (AERATION BLD-7902)

***Function:*** Oxygen is added to the wastewater to ensure microorganism concentration is at optimum levels to metabolize contaminants. (i.e. oxidation of carbonaceous BOD; nitrification (conversion of TKN to $NO_3$-N).

One (1) aeration tank (TNK-501) located in BLD-7902 has an overall effective volume of 48 $m^3$, providing a hydraulic retention time of 16 hours. TNK-501 receives screened wastewater from the screen tank (TNK-401) of the post EQ screen module (SCR-401), return flow from the membrane tanks (TNK-601/ TNK-602), and supernatant from (TNK-901) of sludge dewatering module.

Blowers supply air to the submerged fine-bubble diffusers to ensure biological oxidation (aeration) and to keep solids in the water suspended. Mixed liquor is constantly re-circulated from the bottom of the tanks to the top through spray nozzles. This recirculation process is in place for foam suppression. Alum and soda ash chemical metering systems are in place to ensure regulation of aeration tank water pH and phosphorus levels.

The aeration tank (TNK-501) is equipped with:

- level, temperature, pH, and dissolved oxygen (DO) monitoring and control equipment.
- 2 electric immersion heaters (H-501/H-502) to keep the temperature of the biological process above 15-20° C.
- Blowers (B-501, B-502) equipped with VFD's to supply air to the fine-bubble air diffusers in (TNK-501)
- 30 EDI fine-bubble air diffusers
- Tank recirculation/sludge removal pump (P-503)
- Tank discharge pumps (P-501/P-502) transfer wastewater to the membrane tanks (TNK-601/TNK-602)
- Chemical Metering Systems – soda ash tank (TNK-6101) with dosing pump (P-6101) and alum tank (TNK-6102) with dosing pump (P-6102)

**<u>Temperature Control</u>**

The aeration tank (TNK-501) is heated via electric immersion heaters (H-501/H-502). Temperature in the tank is controlled via a local thermostat. Recommended temperature setting for TSL-301/TSL-302 is 15°C to 20°C.


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### Alarms

If the Temperature Switch Low Low (TSLL-501) is tripped an alarm signal will register on the HMI and the flashing red beacon light will illuminate.

**Note**: As a low water level in the tank can cause damage to the heaters, the Level Switch Low Low (LSLL-501) is installed in the equalization tank to protect the immersion heaters and if tripped will shut the tank heaters off and initiate an alarm signal from the PLC.

## Discharge Pump/Level Control

The aeration tank (TNK-501) has two (2) external transfer pumps (P-501, P-502). Pump (P-501) transfers wastewater to membrane tank (TNK-601) and pump (P-502) transfers wastewater to membrane tank (TNK-602).

Level transmitter (LT-501) indicates the liquor level in the aeration tank (TNK-501). As long as the level in the tank is above set point the PLC will allow the operation of both discharge pumps (P-501 or P-502).

### Alarms

If the Level Switch High High (LSHH-501) is tripped an alarm will register on the HMI, the flashing red beacon light will illuminate and the equalization discharge pumps will be shut down or disabled from running for the duration of the high high level condition.

The aeration tank discharge pumps (P-501/P-502) have pressure indicators (PI-501/PI-502) to measure discharge pressure and motor current switches (YA-P501/YA-P502). The discharge pressure can be used to determine an estimation of the flow rate based on the pump curve.

### Alarms

In the event the aeration tank discharge pumps motor current switches (YA-P501/YA-P502) trip, an alarm will register on the HMI and the red beacon light will flash.

## Dissolved Oxygen Control

The aeration tank (TNK-501) is equipped with a dissolved oxygen (DO-501) sensor. The PLC is programmed to ensure the level of DO remains above 2 mg/L. If the level of DO falls below the set point value a 4-20 mA signal is sent to the VFD (VFD-501) that controls the speed of the blowers (B-501, B-502).The speed of the blowers is regulated to maintain the DO at set point level.

### Alarms

In the event the Dissolved Oxygen level set point cannot be achieved within 15 minutes of the detection of the level being outside of the set point range a low DO alarm will register on the HMI and the red beacon warning light will illuminate. The duty blower will run at full speed for


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15 minutes to attempt to regain the oxygen level. If after 15 minutes the oxygen level has not returned to below set point the duty blower defaults to a manual speed setting until operator intervention is possible.

## pH Control

A chemical dosing pump (P-6101) is provided to inject soda ash ($Na_2CO_3$) into the aeration tank (TNK-501) to maintain the pH at desired pH set point. If the pH measured by pH probe (PH-501) falls below set point, the PLC will turn the pump on for 30 seconds, turn the pump off for 30 seconds and repeat this cycle until tank pH has regained desired set point. The pump stroke must be set by the MBR system operator.

### Alarms

In the event the pH level set point cannot be achieved a low or high pH alarm will register on the HMI and the red beacon warning light will illuminate. The system will continue to adjust to achieve set point pH throughout the duration of the alarm.

## Phosphorus Concentration Control

A chemical dosing pump (P-6102) is provided to inject alum [$Al_2(SO_4)_3$]. The dosing pump will be stroked based on an influent volume set point entered on the HMI by the system user. Alum is used to remove phosphorus from the influent. The alum dosage volume is manually set locally at the metering pump by adjusting the pump stroke.

## Foam Suppression

The aeration tank (TNK-501) is equipped with an external pump (P-503) and a spray nozzle system for foam suppression. The pump (P-503) has a pressure indicator (PI-503) measuring its discharge pressure. The flow is controlled by opening a manual gate valve installed in the foam suppression line. The foam suppression line is equipped with a de-ragger unit to prevent spray nozzles from plugging.

## Sludge Dewatering Unit Supernatant Return

Supernatant can be returned to the aeration tank (TNK-501) if the MBR system is operating in conjunction with a sludge dewatering system. Supernatant will be returned as long as the aeration tank level is below the High Level set point. The PLC will shut down pump (P-503) for the duration of the return cycle.

## Sludge Removal

A sludge removal pipeline is provided at a tee off of the aeration tank recirculation line, isolated by a manual ball valve. The manual isolation valve must remain closed at all times. To remove sludge the manual isolation valve is opened along with the manual isolation valve at the entrance of TNK-901, while P-503 is running.


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### 5.1.2.3 Membrane Filtration (TNK-601/602)

***Function***: Mixed liquor filtration and supplemental biological oxidation.

Membrane filtration is comprised of a membrane tank and permeate extraction unit

Membrane unit includes:

- Two (2) membrane tanks, each tank is equipped with submersible membrane filtration module, level controls, gravity recycling line, drain, access hatch, viewing window, and sample port
- Blower unit for membrane tanks; each unit contains five (5) blowers and it is equipped with pressure indicator, pressure switch low alarm, and motorized three-way valve
- Recirculation pumps transferring mixed-liquor from the membrane tanks (TNK-601/TNK-602) to the aeration tank (TNK-501)

Permeate extraction unit includes:

- Permeate pumps (P-701/P-702) with VFD, current switches, pressure and flow rate control equipment, solenoid valves, and motorized valves
- Backwash tank (T-801) equipped with level control switches, submersible pump (P-801), and solenoid valve
- UV disinfection unit with two (2) UV lights (UV-751/UV-752)

**Membrane Unit Operation**

External pumps (P-501/P-502) housed in (BLD-7900) transfer mixed liquor from the aeration tank (TNK-501) to the membrane tanks (TNK-601/TNK-602). Each membrane tank contains One (1) MicroClear™ MB3-1 submerged membrane module (membrane cassettes are complete with stainless steel housing and permeate piping with header).

Each membrane tank is equipped with air diffusers for the purpose of scouring the membranes to assist in the prevention of membrane fouling.

Mixed liquor from the membrane tanks (TNK-601/TNK-602) is constantly recycled back to the aeration tank (TNK-501) by external pumps (P-601/ P-602) to maintain even biomass inventory within the aeration tank and membrane tanks.

Each of the respective pumps (P-601/P-602) are equipped with pressure indicators (PI-603/PI-604) to measure the discharge pressure of the pumps, and current switches (YA-601/YA-602). The membrane tanks are also equipped with gravity overflow lines that recycle mixed liquor back to the aeration tank (TNK-501).

**Membrane Tanks Level Control**

The membrane tanks (TNK-601/TNK-602) contain high level switches (LSH-601/LSH-602) which activate the permeate pumps (P-701/P-702) to start pulling permeate out of the membrane tanks (TNK-601/TNK-602).


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### Alarms

The level switches high high alarm (LSHH-601/LSHH-602) inform the operator of an imminent overflow. It also shuts off the aeration tank discharge pumps (P-501/P-502) to prevent more mixed liquor from entering the membrane tank (TNK-601/TNK-602).

## Recycle Pump Control

Recycle (RAS) pumps (P-601/P-602) recycle mixed liquor from membrane tanks (TNK-601/TNK-602) back to the aeration tank (TNK-501) as long as the discharge pumps (P-501/P-502) are on, water level switches in the membrane tanks (LSH-601/LSH-602) are ON, and there is no High High Level in aeration tank.

### Alarms

In the event the RAS pumps motor current switches (YA-601/YA-602) trip, an alarm will register on the HMI and the red beacon light will flash.

## Blower Units Control

The membrane air scouring blowers (B-601 to B-605 for TNK-601 and B-606 to B-610 for TNK-602) are connected to the air diffusers in the membrane tanks (TNK-601/TNK-602) respectively. The common airlines to the membrane tanks are equipped with a discharge pressure indicators (PI-601/PI-602) and a pressure switches (PSL-601/ PSL-602).

Each blower unit is also equipped with an electrically actuated three-way valve (MV-601/ MV-602) to direct the flow of air through medium air diffusers or coarse air diffuser. The valves (MV-601/MV-602) are installed with closed position switches (ZSC-601/ZSC-602) that is monitored by the PLC.




The blowers scouring the membranes:

- Operates continuously **(24/7)**
- Turned off for one minute every hour to relax the membranes

### Coarse Air Diffuser Cycle

Under normal operation, air is directed through the medium air diffusers at the base of the membrane housing. If the level switch high (LSH-601) has not been reached in 30 minutes, the air is diverted to the coarse air diffusers in the membrane tank. Changing where air enters into the membrane tank (TNK-601) changes the direction of scouring, helping remove debris on the membrane modules/cassettes.

The air will be directed to the coarse air diffusers for the time interval set point entered through the HMI. The duration of the coarse air diffuser cycle time is adjustable up to 15 minutes, by changing the set point on the HMI screen to meet the particular plant operating conditions.


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**Blower for scouring air must be on 24/7, as failure of air supply can lead to clogging of the air diffusers and membranes.**

**Alarms**

If the pressure switches low alarm (PSL-601/PSL-602) are tripped, a signal will be sent to the PLC which will generate an alarm indicating a potential blowers (B-601 to B-610) malfunction which will cause the corresponding membrane permeate tank discharge pumps (P-701/P-702) to stop. This interlock is in place to prevent damaging the membranes.

**Please note: At no time shall the vacuum pumps P-701/P-702 operate when the pressure switches (PSL-601/PSL-602) are active; this is to ensure that air for membrane scouring is available at all times, and to protect the membranes from fouling.**

## Permeate Extraction Unit Operation

Vacuum pumps (P-701/ P-702) draw the water through the membranes under a preset flow rate of 31.5 Lpm (at a design flux of 18 LMH). Permeate is run through UV system for final disinfection before entering permeate storage tank (TNK-811).

## Permeate Flow Control

There are two (2) operational modes for permeate flow control, flow mode (constant flux mode) or vacuum mode (constant TMP mode).The operator has the option of selecting the permeate flow control mode on the screen. Flow transmitters (FT-701/FT-702) are installed on the permeate discharge line to measure the effluent flow from each membrane tank.

## Flow Mode (default for newterra MBR)

- Normal permeate flow rate is 31.5 Lpm (corresponds to a design flux rate of 18 LMH)
- This setpoint is used for vacuum pumps (P-701/P-702) VFDs control
- The maximum permeate flow setpoint is 52.5 Lpm (corresponds to a maximum flux rate of 30 LMH)
- The operator has the option of changing the permeate flow rate on the screen, but the set point should not be greater than 31.5 Lpm under normal operating condition and cannot exceed 52.5 Lpm, at any given time

**Note: If the vacuum reaches -0.250 bar the system automatically switches to Vacuum Mode.**


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## Vacuum Mode

There are two vacuum set points for the permeate withdrawal system:

- Normal vacuum rate to pull the permeate out at a pre-set vacuum setpoint of -0.100 bar
- Higher vacuum rate (-0.120 bar) is used when the EQ tank's high level (LSH-301) is on, signalling the MBR to run at a higher vacuum to keep up with the incoming water
- The highest vacuum of the permeate extraction system is -0.300 bar

## Permeate Discharge Pump Control

The permeate discharge pumps (P-701/P-702) will run continuously as long as the high level switches (LSH-601/P-602) in the membrane tanks (TNK-601/TNK-602) are activated. Permeate withdrawal is done based on the preset permeate normal flow rate or vacuum rate.

If the level switch (LSH-301) in the equalization tank (TNK-301) is active for more than 5 seconds, permeate pumps (P-701/P-702) start increasing the permeate flow rate using the variable frequency drives (VFD-701/VFD-702). The trans-membrane pressure (TMP) indicated by vacuum transmitters (VT-701/VT-702) and the calculated permeability are displayed on the touch screen. The permeability is a key indicator of membrane fouling state.

## Membrane Relax Cycle

- After every 9 minutes of permeate flow the permeate discharge vacuum pumps (P-701, P-702) will stop and the electrically actuated valves SV-701/SV-702 will open to release vacuum through the membranes.

- The resulting removal of vacuum in the system allows the membranes to relax for 1 minute.

## Membrane Backwash Cycle

- When necessary conditions have been met the backwash tank sump pump (P-801) will be activated, permeate pumps (P-701/P-702) shut off and the backwash supply valves (MV-701/MV-702) open, to allow the reversal of flow over the membrane surface.

- The duration of the relax and backwash time is adjustable by changing the set point on the **HMI** screen to meet the particular plant operating conditions. A combination of backwash and relaxation (no permeation) is carried out for the best performance of the membranes.




- Maximum head required for backwash is **one meter**.
- During the entire backwash cycle, the scouring of the membranes is continuous.

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At design flow when the membrane discharge vacuum exceeds 0.2 bar/80" WC (transmitted by VT-701, and indicated locally at PI-701), or permeability drops rapidly to 50 LMH/bar, it is necessary to take the membrane tanks (TNK-601/TNK-602) offline for chemically enhanced backwash **(CEB)** cleaning (please refer to Section 7 of this O&M manual)..




The permeability is a key indicator of membrane fouling state. A permeability of less than 50 LMH/bar (or transmembrane pressure exceeding 0.2 bar) indicates a membrane chemical clean is required.

A chemical addition unit is provided in the building (BLD-7900) for membrane in-situ chemically enhanced backwash (CEB) and recovery cleaning. The unit includes:

- Citric acid tank (TNK-802) with chemical dosing pump (P-802)
- Sodium hypochlorite tank (TNK-803) with chemical dosing pump (P-803)

## Backwash Tank

The backwash tank (TNK-801) has 3 level switches (LSL-801, LSH-801, LSHH-801). When the low level switch LSL-801 is tripped this indicates a low water level in the backwash tank. Solenoid valve (SV-801) will open to fill the tank to the high level switch (LSH-801).

### Alarms

LSHH-801 indicates imminent overflow. An alarm signal will register on the HMI and the flashing red beacon light will illuminate. **Operator intervention is required**.

## Disinfection System

The MBR permeate is run through UV system for final effluent disinfection. The disinfection system consists of two high intensity UVmax Lights (UV751/ UV752) installed in series. The UVmax lights provide disinfection with a UV dosage of 40 mJ/cm$^2$ and a flow rate of 303 L/min. This system is installed for protection in the event of a membrane breakthrough. The UV-Lights are connected to a solenoid safety (UVL-751, UVL-752) to restrict the flow in case the UV-Light system have been compromised.

## Turbidity Meter

Turbidity transmitter (AIT-801) connected after the UV systems indicates the turbidity (solids content) in the treated effluent. High turbidity will activate an alarm as this can indicate possible breakthrough of the membranes.


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### 5.1.2.4 Permeate /Treated Effluent Building (EFFLUENT BLD-7905)

***Function:*** Treated effluent storage**,** ammonia oxidation with calcium hypochlorite followed by dechlorination.

Prior to final discharge to the receiving water body the treated effluent will be tested. In the event the biological process upset occurs, due to a toxic shock load or cold weather, it may result in a discharge of ammonia or total nitrogen into the receiving water body. Therefore, calcium hypochlorite addition system is supplied as a stand-by solution for ammonia removal in the wastewater. The sodium bisulfite dosing system is used for dechlorination.

The treated effluent from UV lights is stored in four (4) identical storage tanks (TNK-811, TNK-812, TNK-813, TNK-814). All tanks are connected with 3" PVC pipes.

**Calcium Hypochlorite Concentration Control**

Chemical dosing system including calcium hypochlorite tank and dosing pumps (P-813 Duty / P-814 Standby) is provided to inject calcium hypochlorite [$Ca(ClO)_2$] to the tank (TNK-811). The calcium hypochlorite dosage rate is manually set locally at the metering pump by adjusting the pump stroke. The operator must determine what the dosage rate needs to be and manually set the stroke at the pump and enter influent flow rate set point through the HMI.

The calcium hypochlorite tank is equipped with low level switch alarm (LSLL-815) indicating if tank is empty; this is to protect dry running of the pumps (P-813/P-814).

**Effluent Storage System Discharge pumps / Level control**

The storage tanks have two (2) external pumps (P-811 Duty / P-812 Standby) for sending treated effluent to final discharge. Each pump is equipped with discharge pressure indicator (PI-811/ PI-812) to measure the discharge pressure and motor current switch (YA-811 /YA-812).

Tank (TNK-814) is equipped with a high level switch (LSH-814) and low level switch. As long as the water level in the tank is above the low level height, pumps (P-811/P-812) will run.

**Alarms**

All effluent storage tanks (TNK-811/TNK-812/TNK-813/TNK-814) are equipped with level switches alarm (LSHH-801/LSHH-802 /LSHH-803/LSHH-804) for indicating imminent overflow; an alarm signal will register on the HMI and the flashing red beacon light will illuminate, operator intervention is required.


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**Sodium Bisulfite Concentration Control**

Chemical dosing system including sodium bisulfite tank and metering pumps (P-815 Duty / P-816 Standby) is provided to inject sodium bisulfite [$Na_2S_2O_5$] to the discharge line for effluent dechlorination. The sodium bisulfite dosage rate is manually set locally at the metering pump by adjusting the pump stroke. The operator must determine what the dosage rate needs to be and manually set the stroke at the pump and enter influent flow rate set point through the HMI.

The sodium bisulfite tank is equipped with low level switch alarm (LSLL-815/LSLL-816) indicating if tank is empty; this is to protect dry running of the pumps (P-815/P-816).

### 5.1.2.5 Sludge Treatment Module (SLUDGE BLD-7904)

Excess waste activated sludge (WAS) from the aeration tanks (TNK-501) is pumped to the sludge treatment module housed inside container (SLUDGE BLD-7904), Room#1 Cl1 Div 2.

Sludge treatment module includes:

- Polymer tank (TNK-902) with mixer (M-902), and polymer transferring pump (P-902)
- Sludge mixing tank (TNK-901) equipped with level control switch, mixer (M-901), and transferring pump ( P-901)
- One (1) Filter Press unit equipped with air driven hydraulic pump, and sludge dumpster
- Supernatant tank (TNK-903) equipped with level control switches, and supernatant transferring pump (P-903)
- Air compressor (C-901) equipped with oil level switch and pressure switch; air compressor located in Room #2 GP of the building (SLUDGE BLD-7904)

**Polymer preparation unit**

The polymer unit is used for preparation and dosing polymer solution into the mixing tank (TNK-902) for sludge treatment. The batch-wise polymer preparation process includes:

- Hydration stage, when dry polymer is added to the tank for mixing with potable water
- Blending the polymer to a homogenous and activated solution, when the gentle agitation/mixing is provided
- Dosing the polymer activated solution into the sludge mixing tank (TNK-901) for sludge treatment using air diaphragm pump (P-902)

The mixer (M-902) and the pump (P-902) are driven by compressed air supplied by air compressor (C-901). Compressed air lines are equipped with pressure indicators (P-901/P902) to measure pressure in the air lines. The mixer (M-902) and the pump (P-902) are operated manually.


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## Sludge mixing unit

The waste activated sludge is pumped from the aeration tank (TNK-501) into the mixing tank (TNK-901) where it is mixed with the polymer solution sent by pump (P-902) from the polymer tank (TNK-902). The sludge is mixed with polymer by submersible mixer (M-911). The mixer is driven by compressed air supplied by air compressor (C-901); compressed air line is equipped with pressure indicator (P-903) to measure pressure in the air line.

### Alarm

The mixing tank (TNK-901) is equipped with level switches alarm (LSHH-901) indicating imminent overflow; an alarm signal will register on the HMI and the flashing red beacon light will illuminate, operator intervention is required. If the high high condition occurs an if the sludge transfer pump is running the PLC will shit P-503 off.

Treated (flocculated) sludge is transferred from mixing tank (TNK- 901) to the filer press (FP-901) by air diaphragm pump (P-901); compressed air line is equipped with pressure indicator (P-904) for measure pressure in the air line.

## Filter press

The incoming treated sludge enters the filter press (FP-901) via the center feed pipe. The center feed plates contain a recess on either side of the plates. The cylinder will be shut closed (and hence compress the plates together) with the air driven hydraulic pump and then pressurized shut with approximately 4300 PSI of pressure. When the plates are closed, a cavity is created between the plates where the sludge will be captured.

The filtered water (supernatant) exits through the filter cloth (while the solids are captured within the clothed chambers) and goes to the supernatant tank (TNK-903) by gravity.

The feed pressure of the filter press (FP-901) may start at about 25 PSI, due to the low resistance of an empty filter press. As solids accumulate in the chambers of the filter press, the feed pressure will need to be increased to maintain a stroke count of about one stroke every 1-5 seconds or until a maximum feed pressure of 100 PSI is obtained.

Once the filter press (FP-901) is filled with sludge, the feed pump (P-901) and air driven hydraulic pump are shut off and the sludge blow down process will then commence for further water removal. The air enters via air valve into the sludge chamber via the upper left hand corner of the three button plates, and exits via the bottom right hand corner of the one button plates. This process will push excess water out through the outlet manifold.

Once the sludge blown down process is complete, the filter press is ready to be opened. To open the automatic filter press, reverse the air valve on the automatic pump to allow the pump to slowly pull open the pushing plate. For opening and closing the filter press the controls are right on the hydraulics for safety reasons. It is a forward, off, reverse lever.

Now that the plates are released, index the plates one by one, and most of the sludge will fall into the sludge dumpster below the press. A sludge spatula is provided to aid in the sludge removal.


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Once all plates are clean, the filter press (FP-901) is ready to be closed hydraulically. The three outlet manifold ball valves should be opened, the center feed pipe should be opened and the pump is ready to be turned on again.

### Supernatant unit

The supernatant tank (TNK-903) receives spernatant from the filter press (FP-901). The tank is equipped with:

- Liquid level switches (LSL-902/LSH-902/LSHH-902)
- Pump (P-903) transferring supernatant from the supernatant tank (TNK-903) to the aeration tank (TNK-501) located in the building (AERATION BLD-7902); pump is equipped with current switch (YA-903) and pressure indicator (PI-903) for pressure control.

## Level / Pump Operation and Control

The supernatant transferring pump (P-903) will run based on liquid level in the supernatant tank (TNK-903):

- Pump (P-903) run, when level switch LSL-902 is ON and YA- 903 is ON
- Pump (P-903) stops, when level switch (LSL-902) is OFF; this is to protect dry running of the pump

### Alarms

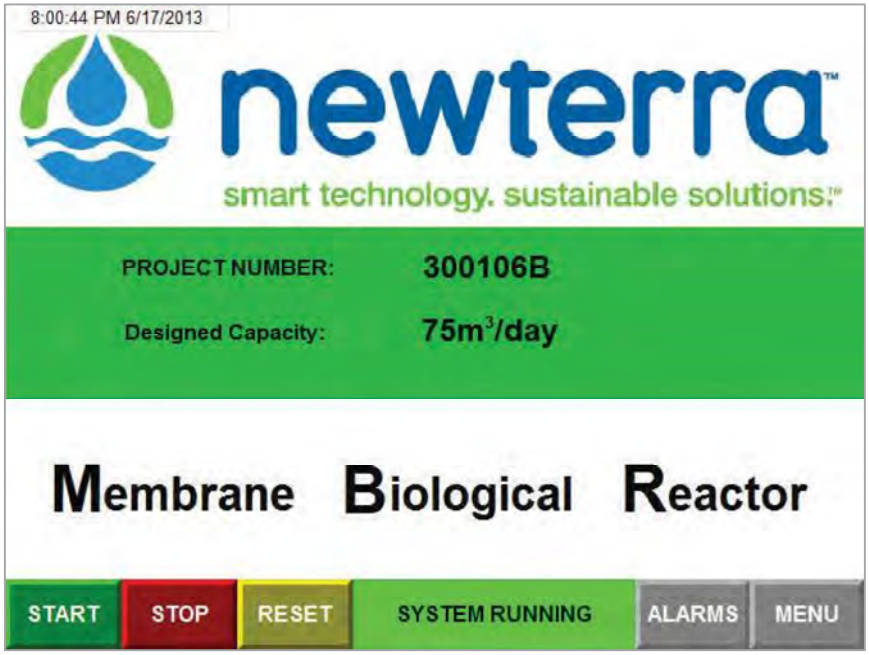
LSHH-902 indicates the imminent overflow. Operator intervention is required.


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## 5.2 Process Control System Touchscreen Operation

The MicroClear™ MBR system is designed to be fully automatic. Since the unit operates through a touchscreen, simply press the screen in an area where a button or text appears.

### 5.2.1 Main Control Screen




**System Operation Commands**

- **START** button puts the system in **RUN** mode
- **STOP** button stops the system operation. Some equipment continues to run even after this **STOP** button has been pressed, however the **E-STOP** button (located on the panel front) will stop all equipment
- **RESET** button is used to clear alarms after they have been addressed
- **SYSTEM ON (RUNNING) / SYSTEM OFF** indicates whether the system is currently in RUN mode or turned off
- **ALARM** button - when it is flashing red (it is on), it indicates an alarm is present in the system. Press **ALARMS** button to be routed to the alarm screen
- **MENU** button is used for screen navigation to show individual screens


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### 5.2.2 Process Screens

The main process screens are accessed from the main menu by pressing either the “BIOLOGY” button or the “MBR SYS” button.

On the main process screens, switches are displayed as **Grey** when **OFF, Green** when **ON** and **Red** when in alarm condition.

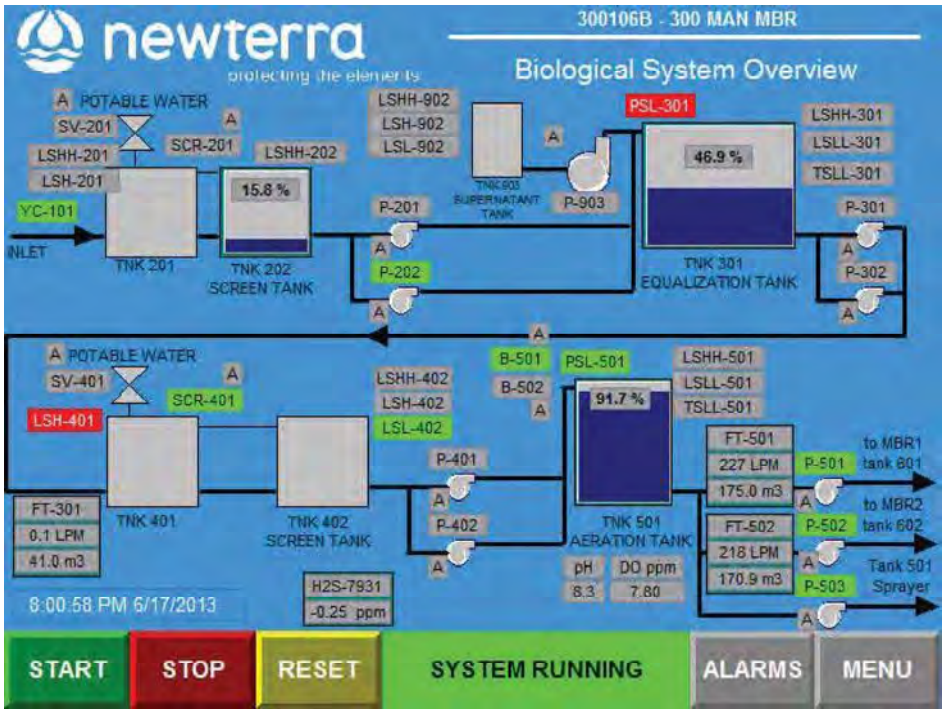
- LSHH – level switch high high
- LSH – level switch high
- LSLL – level switch low low
- TSHH – temperature switch high high
- LSL – level switch low
- PSL – pressure switch low

Individual devices can be monitored and controlled from the process screens.

- The letter indicated beside a device shows the current operational status of that device (**H** for hand, **O** for off, **A** for automatic)
- Touching a device on the process screen will open an **HOA** popup for that device.
- Devices are shown in green if they are currently running


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### 5.2.2.1 Biological System Overview Screen

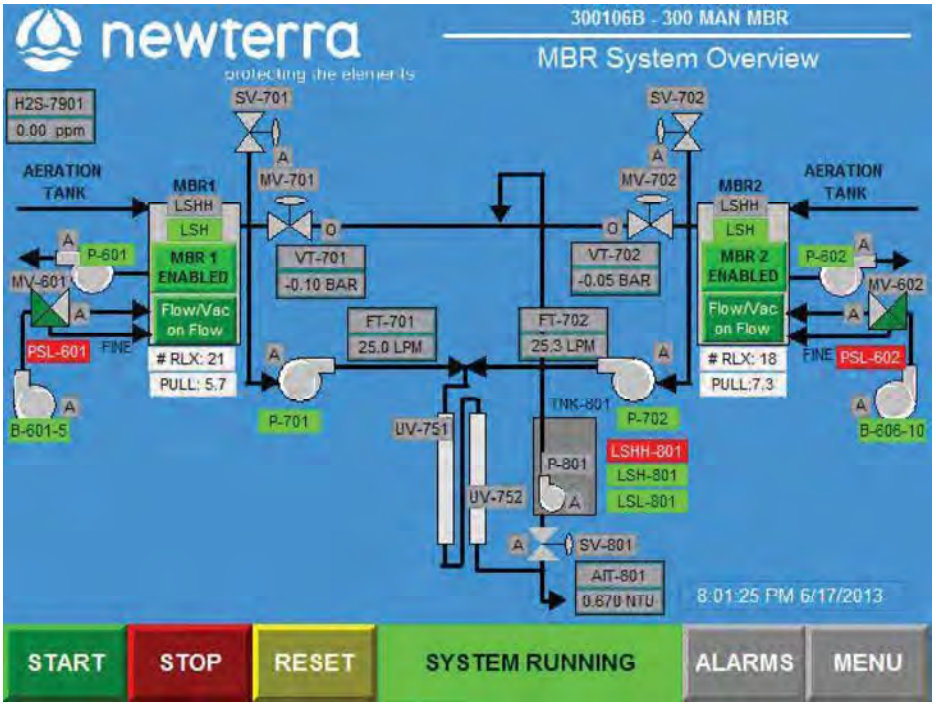



On the Biological System Overview Screen the following equipment and parameters are displayed:

- Inlet screen module (SCR-201) including screen basin (TNK-201) connected with screen tank (TNK-202), pumps and controls
- Equalization module including EQ tank (TNK-301) with controls, blowers; EQ tank level is displayed in %
- The second screen module (SCR-401) including screen basin (TNK-401) connected with screen tank (TNK-402), pumps and controls
- Aeration Tank (TNK-501) with all interconnecting piping, pumps and controls. Aeration tank level is displayed in % , dissolved oxygen (DO) and pH is displayed for the tank
- Status of blowers, pumps, level switches, flow transmitters and $H_2S$ detector are displayed


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### 5.2.2.2 Membrane Filtration System (MBR) Overview Screen

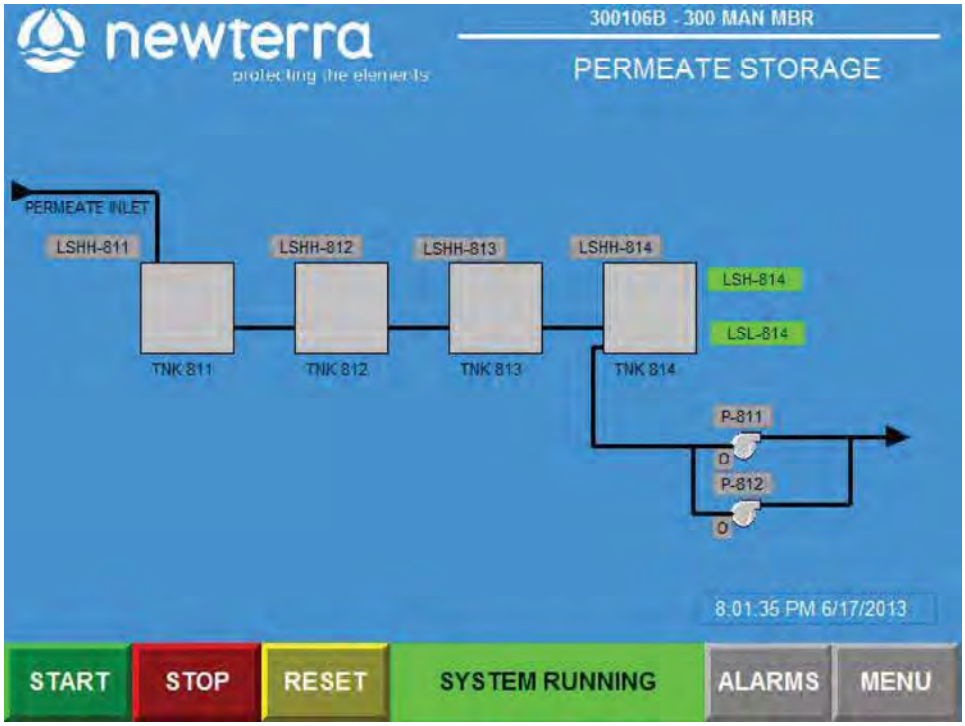



On this screen the following equipment and parameters are displayed:

- Membrane Tanks (TNK-601 and TNK-602), and Backwash Tank (TNK-801) with all interconnecting piping
- Permeate flow and vacuum are indicated for both membrane systems
- The number of relaxes performed in the current cycle is displayed
- The time on the current pull cycle is displayed
- Status of blowers, pumps, level switches, flow transmitters and $H_2S$ detector are displayed
- The time on the current pull cycle


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### 5.2.2.3 Permeate Storage Module Overview Screen




On this screen the following equipment and parameters are displayed:

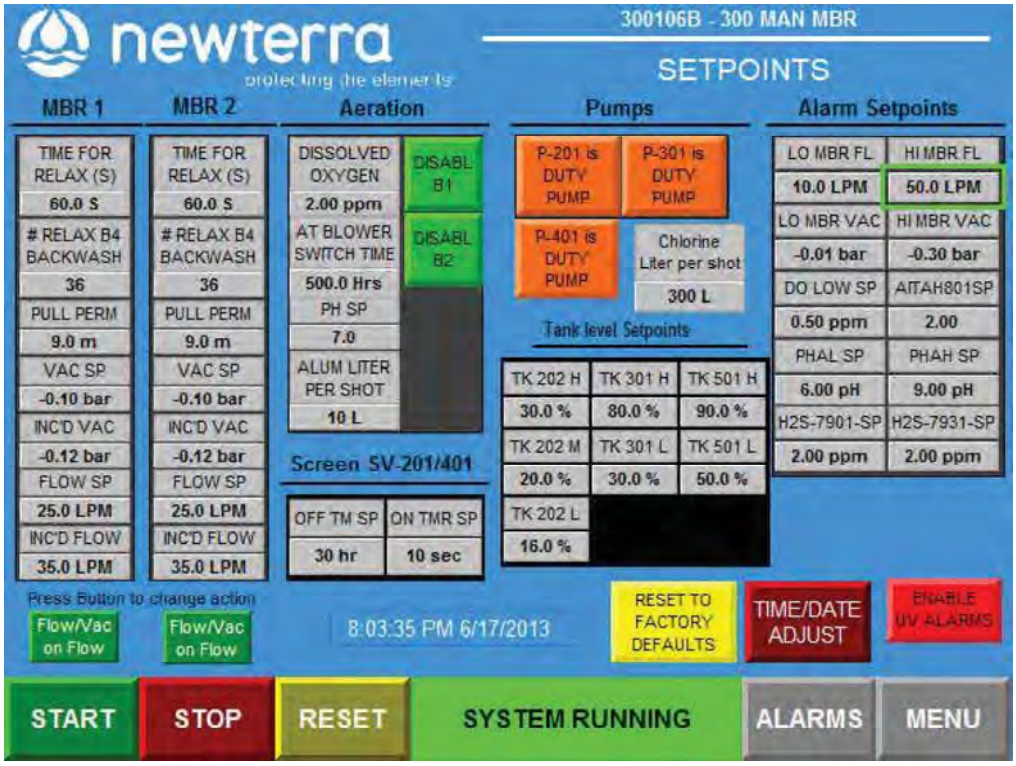
- Permeate Storage Tanks (TNK-811/TNK-812/TNK-813/TNK-814) with all interconnecting piping and pumps
- Status of level switches and pumps are displayed


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### 5.2.3 Process Setpoints Screen

The **Setpoints Screen** is accessed from the main menu by pressing the **"SETPOINTS"** button. This screen allows optimization of the system operation. Once the system is correctly set up, these values **should not be changed**.




See the table on the following page for the description of setpoints.


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## newterra MBR Operational Setpoints Description

| Process Location | Setpoint | Value | Description |
|---|---|---|---|
| **Inlet Screen Module (SCR-201)** | OFF TMR SP | 30 hr | Setpoint for the amount of time when solenoid valve (SV-201) used for potable water delivery for screen cleaning is closed (OFF) |
| | ON TMR SP | 10 sec | Setpoint for the amount of time when solenoid valve (SV-201) used for potable water delivery for screen cleaning is open (ON) |
| **The second Screen Module (SCR-401)** | OFF TMR SP | 30 hr | Setpoint for the amount of time when solenoid valve (SV-401) used for potable water delivery for screen cleaning is close (OFF) |
| | ON TMR SP | 10 sec | Setpoint for the amount of time when solenoid valve (SV-401) used for potable water delivery for screen cleaning is open (ON) |
| **Membranes** | TIME FOR RELAX (S) | 60 sec | Setpoint for the amount of time the membrane relaxes between pulls, in seconds (shown for MBR 1 & MBR 2) |
| | # RELAX B4 BACKWASH | 36 | Setpoint for the number of relaxes before a backwash is triggered. |
| | PULL PERM MBR 1 | 9 min | Setpoint for the amount of time (in minutes) the system pulls permeate from TNK-601 before relaxing |
| | PULL PERM MBR 2 | 9 min | Setpoint for the amount of time (in minutes) the system pulls permeate from TNK-602 before relaxing |
| | VAC 1 SP | -0.10 bar | Setpoint for the vacuum in TNK-601 (in bar) the system will put on the membrane under normal operating conditions |
| | VAC 2 SP | -0.10 bar | Setpoint for the vacuum in TNK-602 (in BAR) the system will put on the membrane under normal operating conditions |
| | INC'D 1 VAC | -0.12 bar | Setpoint for the vacuum in TNK-601 (in bar) the system will put on the membrane when the system is experiencing a high flow (typically controlled by a high level in the EQ tank) |
| | INC'D 2 VAC | -0.12 bar | Setpoint for the vacuum in TNK-602 (in bar) the system will put on the membrane when the system is experiencing a high flow (typically controlled by a high level in the EQ tank) |


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| Process Location | Setpoint | Value | Description |
|---|---|---|---|
| **Membranes** | FLOW 1 SP | 25.0 LPM | Normal flow setpoint for permeate flow rate (in LPM) in TNK-601. Under normal operation the system will default to this setpoint |
| | FLOW 2 SP | 25.0 LPM | Normal flow setpoint for permeate flow rate (in LPM) in TNK-602. Under normal operation the system will default to this setpoint |
| | INC'D 1 FLOW | 35.0 LPM | Increased Flow setpoint for permeate flow rate (in LPM) in TNK-601. If LSH-301 is activated the system will use the Increased Flow setpoint. |
| | INC'D 2 FLOW | 35.0 LPM | Increased Flow setpoint for permeate flow rate (in LPM) in TNK-602. If LSH-301 is activated the system will use the Increased Flow setpoint. |
| **Aeration Tank** | DISSOLVED 0XYGEN | 2.00 ppm | Setpoint for the amount of dissolved oxygen in ppm in the aeration tank |
| | AT BLOWER SWITCH TIME | 500.0 Hrs | Setpoint for switching between aeration tank blowers under normal operation. The switch time is usually 500hrs. |
| | pH SP | 7.0 | Setpoint for the pH level in the aeration tank |
| | ALUM LITER PER SHOT | 10 L | Setpoint for the amount of alum ( L) added in the aeration tank |
| **Tank Level Setpoint** | TK 202 H | 30.0 % | Setpoint for the high level (in %) for the screen tank (TNK-202) |
| | TK 202 M | 20.0 % | Setpoint for the medium level (in %) for the screen tank (TNK-202) |
| | TK 202 L | 16.0 % | Setpoint for the low level (in %) for the screen tank (TNK-202) |
| | TK 301 H | 80.0 % | Setpoint for the high level (in %) for the equalization tank (TNK-301) |
| | TK 301 L | 30.0 % | Setpoint for the low level (in %) for the equalization tank (TNK-301) |
| | TK 501 H | 90.0 % | Setpoint for the high level (in %) for the aeration tank (TNK-501) |
| | TK 501 L | 50.0 % | Setpoint for the low level (in %) for the aeration tank (TNK-501) |


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## newterra MBR Alarm Setpoints Description

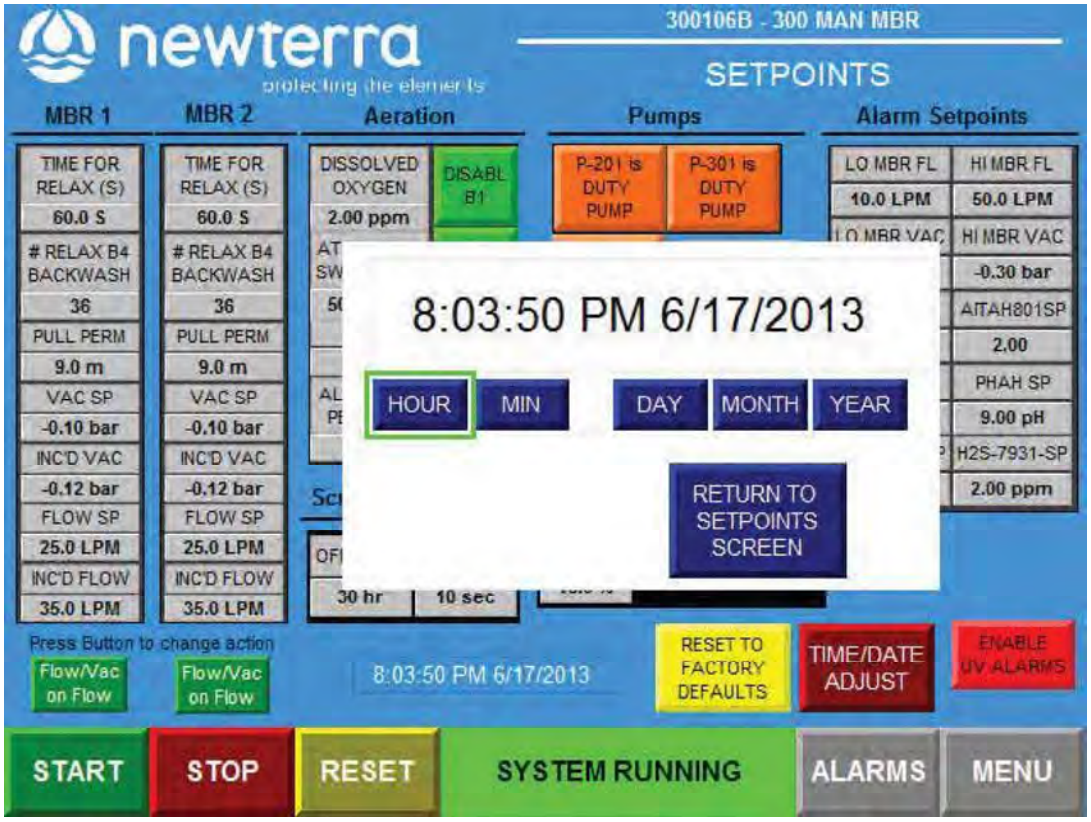
| | | | |
|---|---|---|---|
| **Alarm Setpoints** | LO MBR FL | 10.0 LPM | If the discharge flow is below this setpoint for more than 5 minutes, an alarm will be initiated. |
| | HI MBR FL | 50.0 LPM | If the discharge flow is higher this setpoint for more than 5 minutes, an alarm will be initiated. |
| | LO MBR VAC | -0.01 bar | If the vacuum on the membrane is below this setpoint for more than 60 seconds, an alarm will be initiated. |
| | HI MBR VAC | -0.30 bar | If the vacuum on the membrane is higher this setpoint for more than 60 seconds, an alarm will be initiated. |
| | DO LOW SP | 0.50 ppm | If the dissolved oxygen in the aeration tank is below this setpoint for more than 15 minutes, an alarm will be initiated. |
| | AITAH801SP | 2.0 ppm | If the % solids in the aeration tank is above this setpoint an alarm will be initiated. |
| | PHAL SP | 6.00 pH | If the pH in the aeration tank is below this setpoint for more than 15 minutes, an alarm will be initiated. |
| | PHAH SP | 9.00 pH | If the pH in the aeration tank is higher this setpoint for more than 15 minutes, an alarm will be initiated. |
| | $H_2S$-7901-SP | 2.00 ppm | If the concentration of detected $H_2S$ reaches this setpoint for more than 5 minutes, an alarm will be initiated. |
| | $H_2S$-7931-SP | 2.00 ppm | If the concentration of detected $H_2S$ reaches this setpoint for more than 5 minutes, an alarm will be initiated. |


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**ATTENTION**

The following screen shows **setpoints** modification procedure. **Setpoints** should only be modified under the direction of **newterra** engineers to prevent damaging the membranes.

RESET TO FACTORY DEFAULT (yellow button) - Pressing this button will reset all process and alarm setpoints to the default values at the factory.





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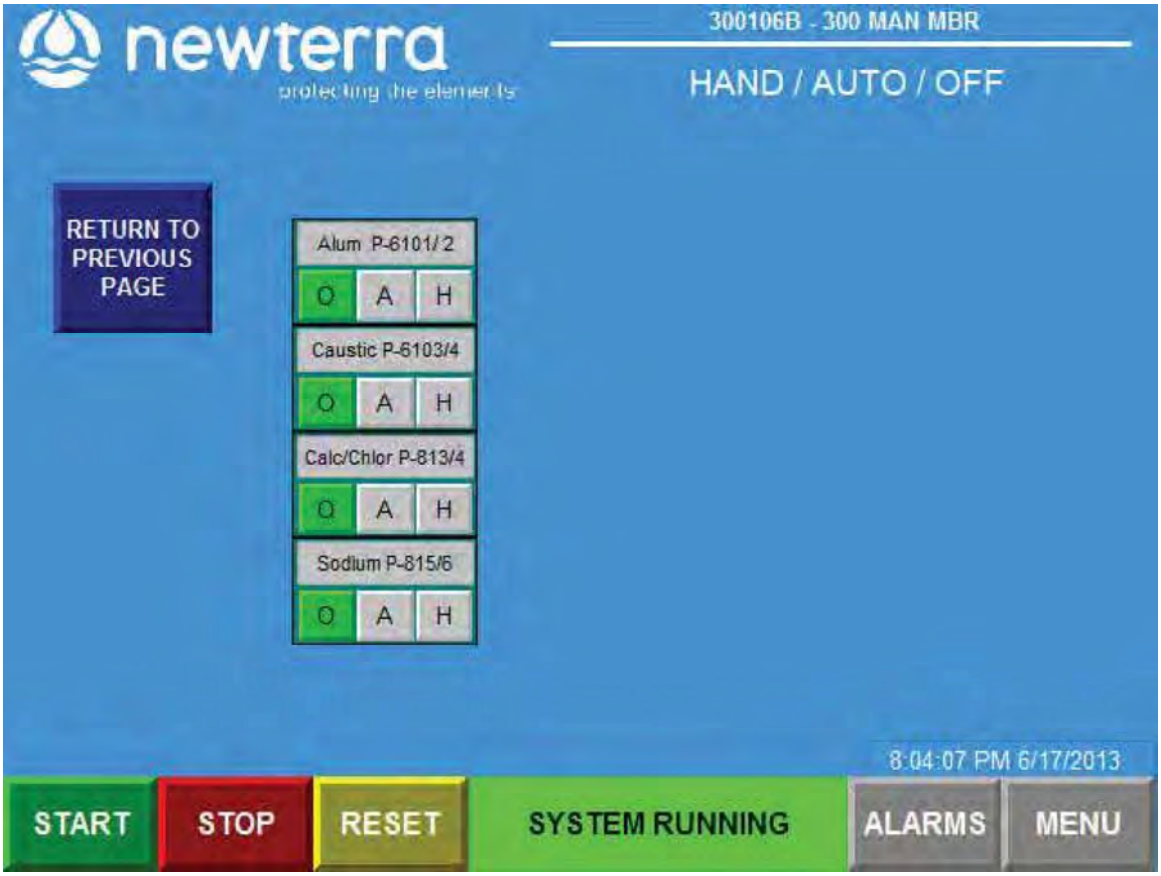
### 5.2.4 System HAO's (HAND /AUTOs/ OFF)

The **Hand / AUTO / OFF** screen is accessed from the main menu by pressing the "**HAO**" button.




- Each PLC controlled motor or valve in the system has **a Hand/Auto/Off (HAO)** Switch to control its operation. This screen displays all the system HAO's
- For normal operation, all switches should be in the **AUTO (A)** position
- The **HAND (H)** position of a switch is used for testing and troubleshooting of the system. As a safety precaution to prevent damage to equipment, the equipment will operate for two minutes in hand mode and will then return to the **OFF (O)** position


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### 5.2.5 Motor Info Control Screen

The following screen shows the status of the VFD's and their PID control values.





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### 5.2.6 Moto Hours Control Screen

Motor Hours screen is accessed from the main menu by pressing the “Motor Hours” This screen shows the total number of hours that each motor can run.

- When the SERVICED button is pressed, it resets the hours since service to zero (0)
- When the REPLACED button of a motor is pressed, it resets the total hours to zero (0).

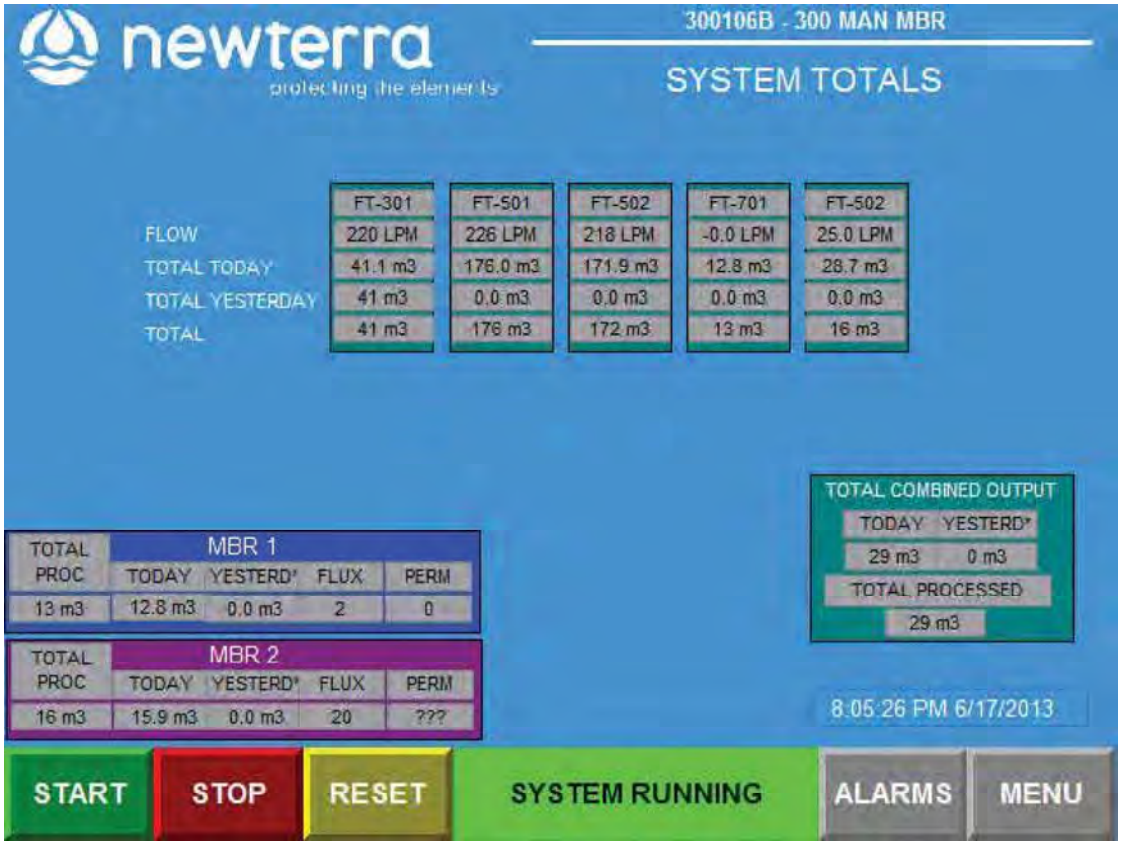




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### 5.2.7 System Totals

The **System Totals** Screen is accessed from the main menu by pressing the **"TOTALS"** button



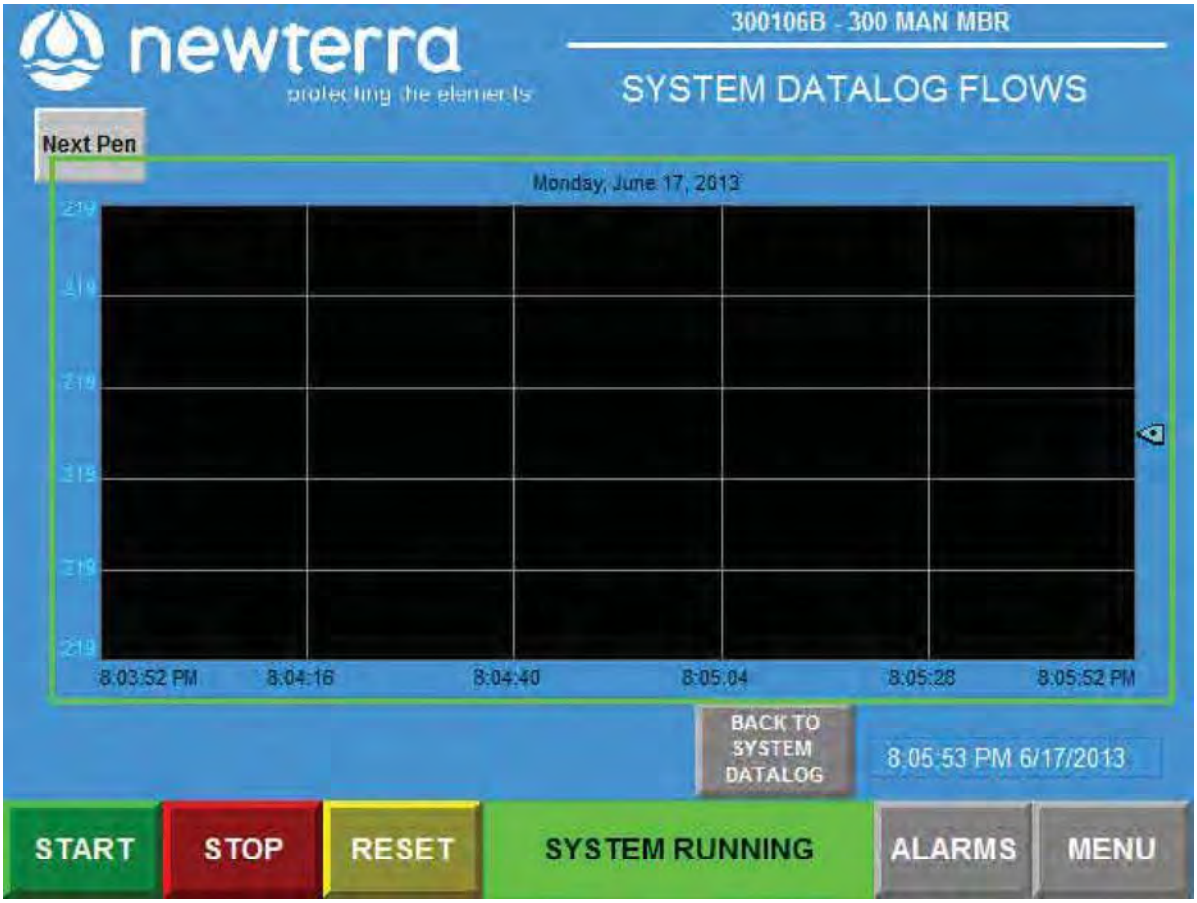

This screen is used to show:

- The total amount of water processed through the process train, and also current (today) amount and amount of water processed yesterday
- Flux (**J**) for membrane unit expressed in **LMH (L/m²·h)**
- Permeability **(K)** for membrane unit expressed in **LMH/bar**


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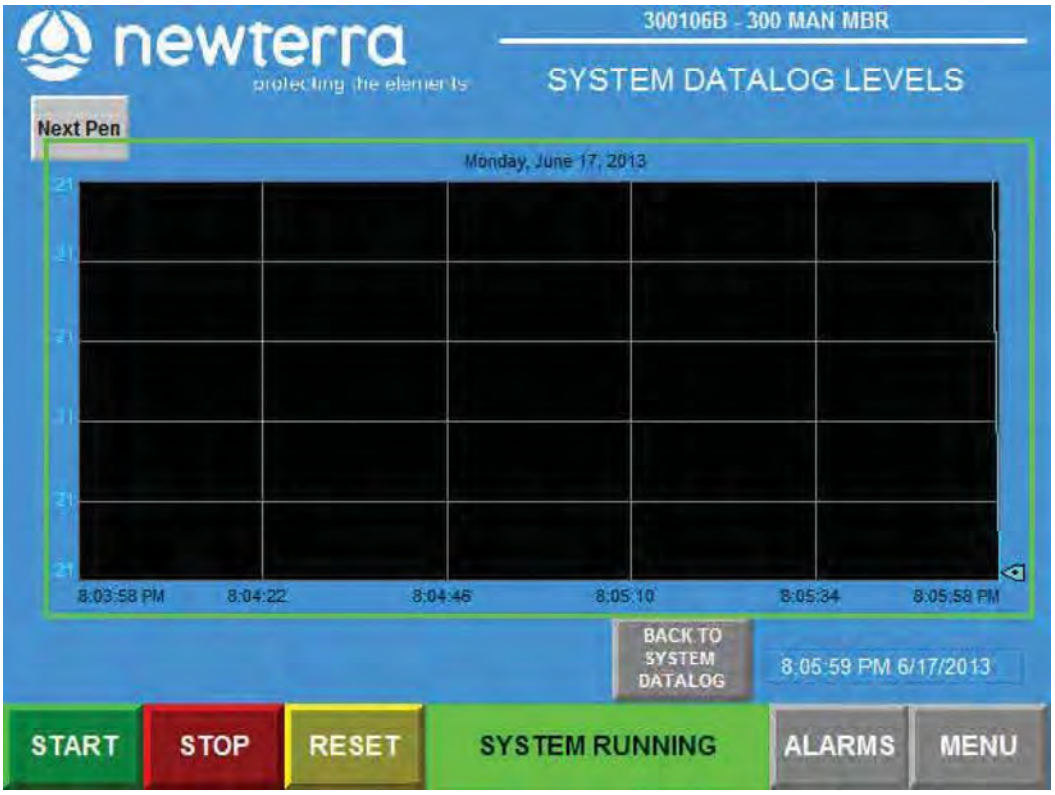
### 5.2.8 System Data Log Screens

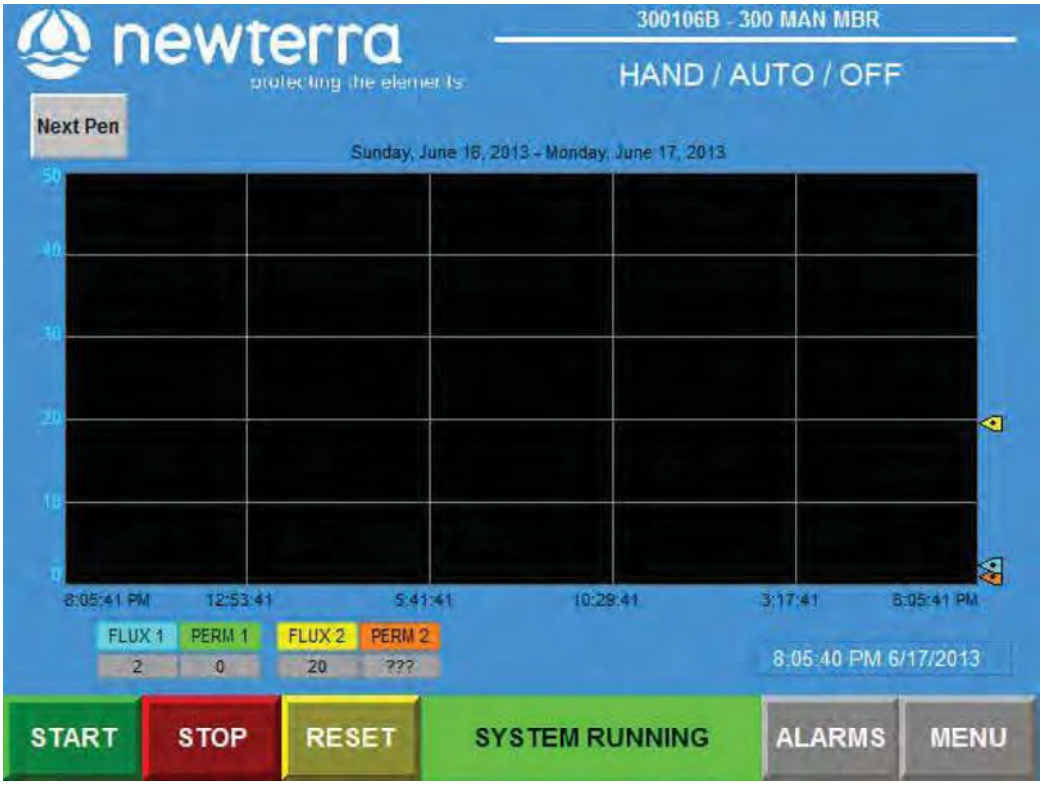
- The following screens show how system is setup with extensive dada log to keep a history of the performance.
- It shows real time data log of critical process operating parameters
- This information is saved on a USB stick that is located on the front of the control panel
- The LOG INTERVAL setting determines how often data points are stored. The factory default setting is 600 seconds





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# 6.0 PLANT START-UP, OPERATING GUIDELINES AND MONITORING

## 6.1 Plant Start-Up

### Mechanical & Electrical Start-up Procedure:

- If the system is being started for the first time, work your way through the **newterra Pre-Commissioning Test Checklist** presented in **Appendix C** of this O&M Manual.
- If the kill switch on the panel (red mushroom shaped button) is pulled out, then push it in to confirm that the MBR system is off.
- Push the reset button on the operator interface to reset all alarms.
- Make sure there are no obstructions over any moving parts, for example a jacket laying on a belt drive.
- Put all HAND/OFF/AUTO switches to AUTO **(A)** mode.
- Pull the kill Button (red button on panel) out to start the process.
- Push the start button on the Operator Interface.

### Process Start-up:

**Seeding**

The procedure for determining the amount of seed sludge required for process start-up, and methods for seeding the system are as follows:

1. Calculate the volume of seed sludge required to ensure that there is a minimum of 3,000 mg/L MLSS in the membrane tank. The volume of seed sludge required can be calculated with the following formula.

$$V_s = \frac{3000 \times V_t}{MLSS_s}$$

$V_s$: Total volume of seed sludge for MBR system ($m^3$)
$V_t$: Total volume of process tanks in MBR system ($m^3$)
$MLSS_s$: MLSS concentration of seed sludge from a similar treatment system (mg/L)

2. Arrange for delivery of fresh seed sludge from an activated sludge system employing a suspended growth type process. If it is possible, obtain seed sludge from a facility treating a similar wastewater and operated with similar processes (nitrification etc).


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3. Drain the water used for clean water testing from the reactor, if the returned activated sludge (MLSS<10,000 mg/L) is used. Do not drain the water after clean water testing, if the dewatered sludge is used.

4. **Screen all seed sludge with the 2 mm basket screen** before the sludge is transferred to the aeration or membrane tanks **to remove gross solids and rags and hair**.

5. Remove grit from the screen if required.

6. Once the tanks are fully seeded in aeration tank and membrane tank is turned on, the system can start to work. Do not waste sludge, as membrane filtration continues, until the MLSS in the aerobic or membrane tank becomes concentrated to the targeted concentration. The system will be started at a reduced design flow/loading initially per **newterra** start-up schedule.

7. Foaming may occur during start-up, which is normal. However, after a period of time (1 week), the foam should disappear. Foaming can be addressed by water spraying, food based defoamer **(silicone based defoamer is strictly prohibited**) addition, or aeration minimization in the membrane tank.

8. If a defoamer is required, contact **newterra ltd**. for recommendation of an acceptable antifoaming agent and dosing quantities.

9. Process start-up and adaptation periods can last for two or three weeks.

10. If fresh activated seed sludge is not available, **newterra** can supply dry cultures bacteria (a consortia group of different kinds of bacteria) for start-up. Please consult newterra ltd; quantities of dry bacteria and procedure of seeding will be confirmed by newterra technical representative during commissioning / start-up period.

| | |
|---|---|
| ATTENTION | No untreated wastewater should enter the membrane tank. Make sure wastewater is completely biologically treated before it gets to the membrane tank |

| | |
|---|---|
| ATTENTION | It is advisable to start the MBR system with a minimum MLSS concentration of 3,000 mg/L to minimize foaming. The seed sludge should come from a plant which has a screen of 2 mm. It is critical to screen the seed sludge with 2 mm perforated screen prior to seeding for membrane protection. |


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## 6.2 System Operating Guidelines and Monitoring

### 6.2.1 Operating Guidelines

The operators are expected to run the MBR system at all times in accordance with the maintenance, operational procedures and details specified in this manual. The following two tables provide operating parameters that can be easily maintained, and define the range of operating values.

**There may be situations where the system needs to operate outside of the conditions covered in this manual. If these conditions develop, please consult newterra ltd. to discuss operation and methods to optimize performance.**

Generally, the following points can be used to operate the MBR system properly:

1. The MBR system is designed to treat wastewater with specified influent characteristics.
2. Never operate the MBR tank below the minimum membrane submerged level. It is necessary to maintain a minimum of 250 mm liquid level above the membrane modules to ensure they are wet at all times and to allow for proper filtration.
3. Always supply the required amount of air for scouring to the membrane module.
4. Always filter wastewater at or below design flow rate.
5. Periodically, relax the membranes by ending filtration while allowing the membrane aeration scour to operate continuously and initiate backwash operation during membrane relaxation (default relaxation mode preset in PLC - permeation continues for 9 min and stops for 45 sec, and backwash the membrane).
6. Always operate the MBR in accordance with the parameters listed in the following tables.
7. Clean the membranes in-place with a dilute chemical in accordance with **Section 7** of the O&M Manual.

**Membrane Filtration Operational Conditions**

| Parameter | Recommended Value | Notes |
|---|---|---|
| **Diffuser Relaxation** | 10 minutes/day | Effluent filtration must be turned off, blower shuts down for 10 mins/day |
| **Relax Time** | 1 min/10 min | Filtration must be off and blower are operating continuously |
| **Backwahing** | 48 cycles | Built-in backwash mode during relaxation mode |
| **In-situ Chemically Enhanced Backwash (CEB)** | 200 ppm as NaOCl | Requires 3 L to fully backwash one MCXL cassette. Frequency of CEB may vary. Refer to Membrane Cleaning Section 7.3 for cleaning procedure. |


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| | | |
|---|---|---|
| **Avg Flux Rate** | 15 LMH (9 gpd) | Average flux rate with permeation 9 minutes out of 10 minutes |
| **TMP** | < 0.2 bar (2.9 psi) | Membranes to be cleaned once the TMP exceeds 0.2 bar (2.9 psi) |

**MBR – Recommended Biological Operational Conditions**

| Parameter | Recommended | Range | Notes |
|---|---|---|---|
| **MLSS (mg/L)** | 10,000 | 8,000 – 15,000 | Never operate the membranes if MLSS < 3,000 mg/l. Sludge wasting should be undertaken as required to maintain target MLSS |
| **Temperature (°C)** | 15 - 35 | 10 – 35 | Avoid sudden changes in temperature. Minimum operating temperature is 15 °C |
| **pH (s.u.)** | 6.8 - 8.5 | 6.0 – 9.0 | Membrane module can handle a change in pH, however it is recommended to keep pH between 6.8 - 8.5 |
| **Aeration Tank, DO (mg/L)** | ≥ 2.0 | 1.0 – 8.0 | This can be maintained by adjusting the volume of air supplied to the aeration tank |
| **Viscosity (mPa-s)** | Not applicable | 0 – 300 | – |
| **Membrane Tank to Aeration Tank Recirculation** | 400% | 200 – 600% | – |
| **F:M (kg BOD/kg MLSS/d)** | 0.1 | 0.03 – 0.2 | F:M = [Flow ($m^3$/d) x BOD conc (mg/l)] / [Process volume ($m^3$) x MLSS conc (mg/l)] |
| **F:M (kg COD/kg MLSS/d)** | 0.15 | 0.05 – 0.3 | F:M = [Flow ($m^3$/d) x BOD conc (mg/l)] / [Process volume ($m^3$) x MLSS conc (mg/l)] |
| **SRT** | > 15 | 12 – 50 | |

Process Troubleshooting Guide is presented in **Appendix M** of this O&M Manual.


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### 6.2.2 Sampling

To ensure accurate system monitoring and the validity of laboratory test data, samples must be collected as outlined below. These are only recommended guidelines. It is imperative that scheduled testing protocols are performed in compliance with local regulatory agency requirements. Composite samples of the MBR systems may need to be sent out to a certified laboratory for testing, based on the local regulatory requirements

**Monitoring and Testing Requirements**

| Parameter*** | Influent | Aeration Tank | Membrane Tank | MBR Effluent |
|---|---|---|---|---|
| **Flow rate** | D (PLC) | | | D (PLC) |
| Fat, Oil and Grease (FOG) | AR | | | AR |
| Alkalinity | AR | | | |
| Biological Oxygen Demand (BOD) | W | | | W |
| Total Suspended Solids (TSS) | W | | | W |
| Total Kjeldahl Nitrogen / Total Nitrogen (TKN / TN) | M | | | AR |
| Ammonia Nitrogen($NH_4$-N) | | | | AR |
| Nitrate Nitrogen ($NO_3$-N) | | | | AR |
| Total Phosphorus (TP) | W | | | W |
| Mixed Liquor Suspended Solids (MLSS) | | | W | |
| Mixed Liquor Volatile Suspended Solids (MLVSS) | | | AR* | |
| Temperature | | D (PLC) | | |
| pH | AR | D (PLC) | | W |
| Dissolved Oxygen (DO) | | D (PLC) | | |
| Filterability | | | TW | |
| Turbidity | | | | AR** |
| Fecal Coliform / *E-Coli* | | | | W |

**Legend: D = daily; W = weekly; TW = three times weekly; M = monthly; AR = as required.**

* If MLVSS /MLSS ratio of a minimum of 0.7 is detected, MLVSS testing can be done periodically, on an "as required" basis.

**The effluent should be routinely checked for any signs of problem. Normally, the effluent is reasonably clear, colourless, and odourless. If the effluent becomes turbid, testing should be carried out required.

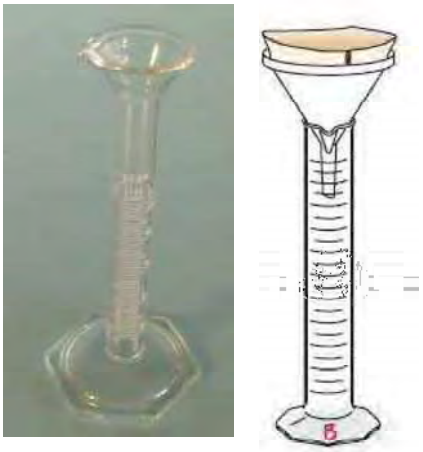
*** Explanation and definition of abbreviations, acronyms and terms used in the manual are presented in **Appendix G – Glossary & Terms and Appendix H – Biological Treatment & Monitoring Parameters.**


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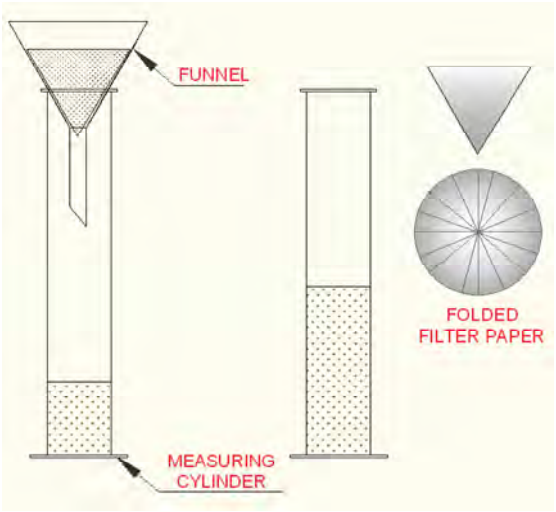
## Filterability Test

The objective of the filterability test is to evaluate the condition of the working biomass. This is assessed by measuring the volume of filtrate passing through the filter paper. If filtrate is greater than 10 mL/10 min, then biomass filterability is acceptable; however, if it is less than 10 mL/10 min, modifications to the plant operating condition are required to prevent premature membrane fouling.

## Laboratory Glassware and Filter Paper








## Apparatus:

Filterability Kit is distributed by **newterra ltd (Part # 24146).**

Filterability Kit includes:

- Filter paper distributed;
- Funnel (75 mm diameter recommended);
- 2 - 50 mL graduated cylinder;

Stop watch


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**Measurement Procedure:**

1. Pleat filter paper by folding in half, quarters etc.
2. Line the funnel with pleated filter paper and place the funnel in the graduated cylinder.
3. Collect 50 mL of activated sludge sample in a beaker and stir.
4. Pour the 50 mL sample into the funnel.
5. Start timer when the first drop of water filtered through the filter paper.
6. After 10 minutes of filtration, record the level of filtrate in the graduated cylinder.

| Filterability (FT) | Action | State of urgency |
|---|---|---|
| > 10 ml | Excellent, no action req' | |
| 5 - 10 ml | Tweak process operation | |
| < 5 ml | Process adjustment req | **Contact newterra ltd.** |

### 6.2.3 Record Keeping

An essential component of quality control in any facility is sound record keeping. A log book covering the entire treatment system performance should be maintained, updated, and readily accessible to all operators. The log book should be used to record observations, set point alterations, and unusual conditions.

For each wet chemistry parameter analysis, a separate work-sheet has to be prepared. Work-sheet data for at least the previous year should be kept for possible consultation.

The second step in quality control is to train all operators to follow an established procedure for each test. Identical samples should be periodically tested for any parameter by different operators, and the variability among results should be compared. Consistent variability in results may lead to the technique improvement of operators.

Duplicate analysis of a sample should also regularly be done. And, split samples should regularly be sent to an outside accredited laboratory and analysis results should be compared with those done in-house.

In addition to summary sheets, it is highly recommended that data should be entered into prepared Excel spread-sheets. Spread-sheets greatly aid in the data presentation and manipulation, and would be of immeasurable value when report writing is required.


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### 6.2.4 Process Trending

Other than pre-planned process changes or major upsets, process modifications should be based on trends shown in the process data. A trend is nothing more than an indication of real change in a process parameter over time. A trend chart is simply a graph of data being trended.

As the graph changes, upward or downward trends are detectable. Smoothing trends by graphing the 3-, 7-, or 30-day average of the data allows the trend to be shown more clearly. Because the individual data point may be questionable, the actual value of data point are less important compared with the trend regarding the process monitoring.

Trend graphs are a part of the Excel data spread-sheet; the operator can trend and analyse many parameters in just a few minutes in order to assess process performance.
When a trend is identified, its indication to the process can be evaluated, and corrective action may be carried out, if needed. Statistically, the more data points there are in a trend chart, the more reliable the trend.


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## 7.0 SYSTEM MAINTENANCE




**CAUTION: Shut off all electrical power before working on the mechanical or electrical equipment.**

The system should be routinely checked for any signs of operational problems. Such problems could include, but are not necessarily limited to, abnormally high peak flows, unpleasant odour, and diffuser clogging, and so on.

### 7.1 Plant Visual Checks

| | |
|---|---|
| **Noise** | During normal operation, there is a uniform humming sound at the plant. In case of an unusual noise, it could be an indication that the blower needs maintenance or repairs. |
| **Smell** | The MicroClear™ MBR is an aerobic system. During normal operation, the system has an earthy smell similar to that of a well-maintained compost pile. If other odours are noticed, the aeration process may not be operating or the system has been overloaded. Check the DO manually and the blower to verify proper operation. |
| **Sight** | Normally, the effluent is reasonably clear, colourless, and odourless. If the effluent becomes turbid, there is a pin hole in the membrane or a leakage in the piping. Take the unit out of operation and investigate. **Check uniformity of membrane air distribution periodically to ensure air scoring is effective across all membrane plates.** |


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### 7.1.1 Air Scouring Patterns in Membrane Tanks

Membrane air scouring check is essential procedure for **newterra** MBR WWTP. Air scour has to be observed for uniformity of bubbling action all across the membrane module/cassette on regular basis.

**A visual inspection of the aeration patterns should be performed with the liquid level 2-3" (5 – 7.5 cm) above the permeate pipe.**



**Proper air scouring in membrane tank**



**Uneven aeration in membrane tank**

It is easy to observe aeration patterns through clear window in membrane tank. Operator should note any unusual patterns of air distribution. The visual inspection also should be performed before any membrane cassette removal from membrane tank. Operator has to check for:

- damage of air diffusers - if this occurs, empty the tank and fix the diffuser;
- air leakages - if this occurs, tighten up the fittings.

If there is insufficient air scouring, localized dewatering (**clogging, sludging, caking and plugging**) may occur and may in turn lead to membrane fouling.


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## 7.2 Schedule for Routine Operation and Maintenance Checkups (if Applicable)

| Location | Item | Day | Week | Month | Quarter | Year | Comments |
|---|---|---|---|---|---|---|---|
| HEADWORKS | **Inspect and maintain grease trap in the kitchen of the work/mining camp** | | X | X* | | | *Kitchen grease trap(s) should be checked weekly and cleaned monthly to ensure proper performance. |
| | **Inspect lift station with sump pumps** | | X | | | | |
| | **Remove grease from lift stations and top of PC tank** | | X | | | | |
| PROCESS | **Perform visual check** | X | | | | | Refer to Plant Visual Checks |
| | **Check for proper wasting to sludge system** | | X | | | | |
| | **Record permeate flow rate** | X | | | | | |
| | **Record DO in the aeration tank** | X | | | | | |
| | **Record pH in the aeration tank** | X | | | | | |
| | **Record vacuum pressure at the membranes** | X | | | | | Normal range: 0.07 – 0.15 bar (28" -61" WC) |
| ***Note: When the vacuum at the membranes reaches 0.2 bar/2.9 psig/80" WC), stop the permeation and perform recovery cleaning (please see procedure separately)*** | | | | | | | |
| MECHANICAL & PROCESS | **Inspect membranes and permeate withdrawal system** | | X | | | | 1 hour |
| | **Clean and calibrate the DO sensor** | | | X | | | 1 hour |
| | **Inspect and maintain valves & fittings for leaks** | | X | | | | |
| | **Clean manually Fine Screen and direct solids to primary settling/sludge holding tank** | | X | | | | may require daily cleaning during start-up (subject to PI502 reading) |
| | **Membrane in-situ cleaning** | | | | X | | 2-4 hours |
| | **Remove membrane module for mechanical cleaning and inspection** | | | | | X | Drain membrane tank. Roll out membrane cassette. Remove membranes and inspect. (1 -2 days) |
| | **Visual inspection of air bubbles in the equalization, aeration and membrane tanks** | | X | | | | Replace diffusers if big uneven bubbles/high turbulence is found. |


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| Location | Item | Day | Week | Month | Quarter | Year | Comments |
|---|---|---|---|---|---|---|---|
| MECHANICAL & PROCESS | **Remove, inspect and maintain diffusers in equalization, aeration and membrane tanks** | | | | | X | This involves a complete draining of tanks (1-2 days) |
| | **Pump out solids collected in the primary settling/sludge holding tank for offsite disposal** | | | | X | | |
| | **Check and record UV instrumentation: % Transmissivity vs required minimum; Remaining Lamp Life; Total Days of Operation** | | X | | | | |
| | **Inspect and maintain pump bearings** | | | X | | | |
| | **Check blower operation (if vibrating)** | | X | | | | |
| | **Check time clock setting** | | X | | | | |
| | **De-ragger (foam suppression unit)** | | | | | | may require daily cleaning during start-up |
| | **Inspect functionality of baseboard heater** | | | | X | | |
| | **Check ventilation systems for container** | | | | | X | |
| ELECTRICAL | **Check electrical leads** | | | | X | | |
| | **Inspect and maintain breakers, fuses, resets and anodes** | | | X | | | |
| | **Check motor mounting bolts** | | | X | | | |
| | **Clean dust away from electric motor** | | | X | | | |
| | **Check PLC and control panel functionality** | | X | | | | |




**All connections (hoses, hose clamps, camlocks) have to be checked periodically (on a monthly basis) to make sure all of them are in good conditions.**


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### 7.2.1 De-ragger operation and maintenance cleaning

Please refer to the drawing presented in **Appendix A** of this O&M Manual.

De-ragger is part of the anti-foaming system which is provided in the system for foam suppression in the aeration tank. The main purpose of a de-ragger in this system is to avoid the spray nozzles clogging by catching fibres and other impurities found in the recirculation water pumped through the system.

De-ragger is simple equipment consisting of a PVC clear pipe, a nylon bristle brush installed in the pipe, and a fernco coupling for quick disconnection. During the water spraying process the brush (with a sliding fit in the pipe) catches fibres and other impurities
.
When the de-ragger is filled with impurities, perform maintenance as follows:

- Turn off P-503 operation.
- Close 2' PVC isolation valve and open 1' PVC drain valve and drain the content to a 20-L pail.
- Disconnect fernco coupling.
- Remove brush and rinse with clean water.
- Close the drain valve and reassemble the fernco coupling.
- Make sure all connections are tight.
- Open isolation valve.
- Turn on P-503 operation.

### 7.2.2 Polymer Make-up Instructions

Please refer to the P&I Diagram presented in **Appendix A** of this O&M Manual.

1. Fill polymer make up tank (conical bottom mixing tank) with 100L clean water
2. Open air mixer speed valve by turning valve one and a half revolutions (1 ½) to allow mixer to run at high speed
3. Slowly add 1 cup (~250ml) of Powdered CC4509 polymer into vortex beside mixer shaft (keep bag sealed when not in use)
4. Run mixer on high speed for 5 min
5. Reduce mixer speed to low by turning value back to half (1/2) a revolution open, continue mixing for 45 min
6. Polymer is now ready to use


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## 7.3 Membrane Cleaning

### 7.3.1 Membrane In-situ Chemically Enhanced Backflush (CEB)



**Chemical cleaning is only to be carried out by qualified and trained personnel! Chemicals can lead to serious injuries. Always wear personal protective equipment (PPE) when handling chemicals! Obey the chemical safety handling procedure as listed in the Material Safety Data Sheets.**

It is recommended that in-situ CEB be carried out before the TMP exceeds 0.2 bar (or permeability drops rapidly to 50 LMH/bar) This is typically done once every couple weeks/months depending on biomass characteristics and system operating condition.

On certain occasions, membrane module/cassette may need to be physically inspected for membrane integrity if membrane permeability performance is not recovered after the cleaning (i.e., suspect of membrane deterioration); please refer to subsection **7.3.3**.



**The maximum backwash pressure of MicroClear™ MCXL filter is 0.1 bar or equivalent to a 100 cm water line. Only use gravity force to perform the backflush.**

**Note: Membrane have a maximum active chlorine tolerance of 100,000 ppm.h.**

For better cleaning performance, it is recommended:

- Potable water (permeate is acceptable if potable water is unavailable)
- Water temperature is above 20 $^{0}$C (better cleaning efficiency if water temperature ranges from 20 to 30 $^{0}$C)

**Procedure**

**Note: Only clean (backwash) one membrane tank at time.**


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***Step 1: Cleaning with sodium hypochlorite (NaOCl)* - 3L cleaning solution required per MCXL cassette for in-situ CEB. The CEB is performed manually.**

1) Press the disable membrane button on the screen.

2) Open valve (SV-801) and allow water to fill up the backwash tank (T-801) to LSH-801 level.

3) Close valve (SV-801).

4) Add concentrated NaOCl into the backwash tank to a concentration of 500 mg/L (acceptable range of 200 to 1,000 mg/L).

Volume of concentrated NaOCl required can be calculated with the following formula,

$$V_x = \frac{V_m \times 0.05}{C_s}$$

$V_m$: Volume of the solution (Gallon, or Litre), equal to 3 L multiplying the number of MCXL cassettes;
$C_s$: Concentrated NaOCl concentration (%)
$V_x$: Volume of concentrated NaOCl required (Gallon, or Litre)

5) Open valve (MV-701 or MV-702) and inject chemical solution by pump (P-801) into membrane tank (TNK-601 or TNK-602) until reach LSL-801 level in backwash tank. (T-801).

6) Soak the membranes in NaOCl solution for 1-2 h. Adjust air scour in interval, if necessary, to control potential foaming.

7) Resume normal operation by turning off the disable membrane button. Check permeability. Normal permeability after cleaning: 150 to 300 LMH/bar.

8) Repeat the cleaning procedures if the normal permeability value is not attained.

***Step 2: Cleaning with Citric Acid – only required in case of inorganic fouling caused by the high hardness.***



**Rinse membrane filter thoroughly with potable water to completely remove NaOCl solution before treatment with citric acid. Mixing NaOCl with citric acid releases toxic chlorine gas!**

1) Repeat the above steps with 0.2% citric acid solution (a max of 2%)


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### 7.3.2 Membrane Recovery Cleaning

The membrane recovery cleaning is to be done once a year at a minimum. On certain occasions, membrane cassette may need to be inspected for membrane integrity (suspect of membrane deterioration, membrane permeability performance does not recover after the cleaning, etc.).




**Disable operation of the dedicated membrane tank that needs to be cleaned by pressing the disable membrane button on the screen.**

For better cleaning performance, it is recommended:

- Potable water is used
- Water temperature is above 20 $^0$C (better cleaning efficiency if water temperature ranges from 20 to 30 $^0$C)

**Procedure**

***Step 1: Cleaning with Sodium Hypochlorite (NaOCl)***

1. Drain all mixed liquor from the membrane tank to the sump/recycle back to the process tanks.

2. Clean (wash down) the membrane tank with potable water and drain the dirty liquid to the sump/recycle back to headwork.

3. Turn off air scour, fill the membrane tank with potable water until the membranes are completely covered, and add NaOCl into the membrane tank to a concentration of 500 mg/L as free chlorine (max. 1,000 mg/L). Turn on air scour for 5 min to mix the solution and turn it off during membrane soak.

   Volume of NaOCl required can be calculated with the following formula:

$$V_x = \frac{V_m \times 0.05}{C_s}$$

$V_m$: Volume of membrane tank (Gallon, or Litre)
$C_s$: NaOCl concentration (%)
$V_x$: Volume of NaOCl required (Gallon, or Litre)


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4. Keep the membranes soaked for a min 12 hours in the NaOCl solution (longer soak time required if severe fouling is evident). Air scour can be on intermittently during soak time (5 min every 4 hrs).

5. Drain spent NaOCl solution to the sump/recycle to headwork.

6. Rinse membrane filter thoroughly with potable water and drain the entire tank. Rinse waters are drained to the sump/recycle back to the headwork.

***Step 2: Cleaning with Citric Acid – only required in case of inorganic fouling caused by the high hardness***



**Rinse membrane filter thoroughly with potable water to completely remove NaOCl solution before treatment with citric acid. Mixing NaOCl with citric acid releases toxic chlorine gas!**

1. Fill the membrane tank with potable water, turn on scouring air, and add citric acid to pH 2.0. Turn off air scour when the pH of 2.0 is reached.
2. Keep the membranes soaked in the citric acid solution for 2 hours (longer soak time required if severe fouling is evident).
3. Drain spent citric acid solution, rinse membranes thoroughly with potable water and drain all the rinse waters. Spent citric acid solution and rinse waters are drained to the sump/recycle back to headwork.

**Step 3: *Resume normal operation***

***Step 4: Checking Permeability on Clean Water***

Normal permeability after cleaning: 150 to 300 LMH/bar.

Repeat the cleaning procedures If normal permeability is not achieved.

**Note: Membrane maintenance (CEB) and recovery cleaning has to be recorded according to Membrane Cleaning Log Sheet presented in Appendix K of the manual**.


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### 7.3.3 Membrane Physical Check



**WARNING***: A membrane cassette that has been in operation weighs more than dry membrane cassette before installation.*
***Failure to comply with the instructions provided in this manual can cause equipment & property damage or severe personal injury, and will render the warranty null and void.***

**To remove membrane module from membrane tank**

This procedure is required if the membranes are being inspected as part of routine maintenance for physical check or being replaced.



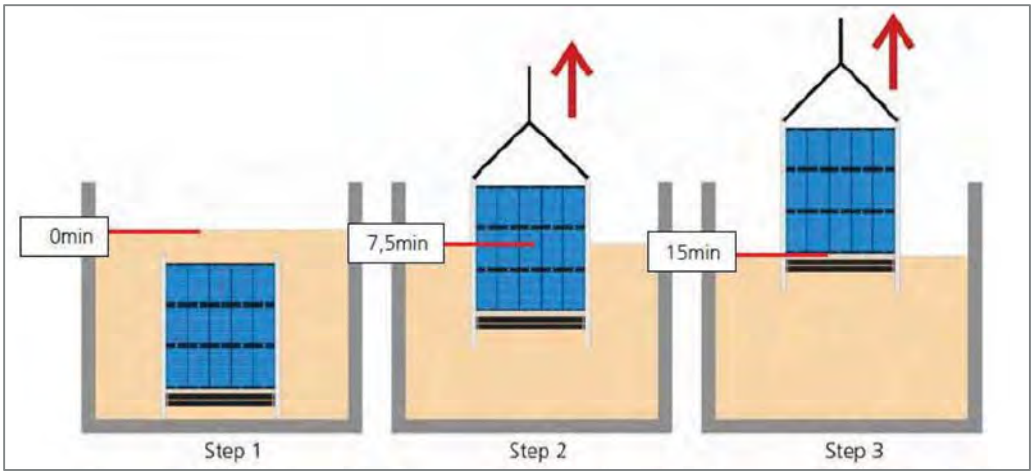
**Once membrane inspection or replacement has begun, it must be completed promptly. It is important that the membrane DO NOT DRY OUT OR FREEZE during this procedure.**

1. Lifting the membrane cassette out of a tank or emptying a tank should take at least 5 min. For each single filter layer.

| MicroClear™ Membrane Module | Filter Layers | Acceptable time for membrane filter lifting out of the membrane tank or empting the tank |
|---|---|---|
| MB2- series | 2 | 10 min |
| MB3- series | 3 | 15 min |
| MB4- series | 4 | 20 min (module must be separated in to 2 parts) |
| MB5- series | 5 | 25 min (module must be separated in to 2 parts) |

**Note: Non observance will lead to damage of the filters because of exceeding the maximum backwash pressure.**


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**Schematic of MicroClear™ membrane module lifting / emptying of the membrane tank**

## Membrane module replacement

***If membranes require changing*** *v*erify membrane modules are secure within the membrane tanks after re-installing the modules – i.e. verify wheel chocks are in the correct location and that there is no lateral movement (less than an inch) of the membrane modules on the wheel tracks in the tank.


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# 8.0 SHUT DOWN

## 8.1 Temporary Shut Down

A temporary shutdown for a few days requires continuous aeration of the biomass to keep the DO level at least 2 mg/L and continues biomass recycle between the bioreactors.

## 8.2 Permanent Shut Down / Winterizing

Permanent shut-down is required if system operation stops at least for 2 weeks without inflow. Permanent Shut Down includes the following procedure:

- Perform membrane cleaning before permanent shut down / winterizing.
- Drain all tanks.
- Remove membranes and winterize
    - For short term storage (up to 6 months): soak membranes in 10 ppm NaOCl solution, and membranes are not allowed to dry out), never expose the membrane unit to frost, dust, rain, or direct sunlight.
    - For long term storage: soak membranes in preservation solution - 20 % glycerin solution (by weight).The glycerin will pass through the membrane via diffusion and provides pore protection from freezing and from drying out.
- Disassemble all PVC ball valves and drain any water inside (open and close to ensure trapped water escapes).
    - Leave all valves ½ open during reinstallation
- Open all drain valves and leave open.
- Clean and reinstall all sprayer nozzles.
- Find all check valves and make sure water is not being held by valve (Wet/Dry Vac works well here).
- Drain / remove all pumps from tanks, ensure no water is left inside the pump.
- Use RV biodegradable Antifreeze to
    - Refill any check valve
    - Dump in 2 (qty) 4-L bottles in each tank
- Remove pH and DO probes (if unit is equipped) and store with membranes in a heated area ensure probes are kept wet.
- Remove power from system.


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Double check and ensure that there is no water left in any pipes, fittings etc. If it is not possible to remove the water fill with antifreeze.

## Glycerine Solution Solution Components and Solution Make-Up

**1. Chemicals:**
Technical Glycerin (86.5%)
Distilled water

**2. Solution make-up procedure:**

Dissolve technical glycerin (86.5%) in water and homogenize according the following table.

| Preservation Solution 20 % Glycerin | Technical Glycerin [86,5%] | Distilled Water |
|---|---|---|
| [kg] | [kg] | [kg] |
| 1 | 0.23 | 0.75 |
| 10 | 2.3 | 7.5 |
| 100 | 23 | 75 |
| 1000 | 230 | 750 |

The preservation solution has a density of 1,045 g/cm$^3$. The concentration of preservation solution can be tested and corrected with a density meter.

## Membrane preservation procedure

- Allow the membrane unit to soak in preservation solution for a few hours.
- Remove the membrane unit and allow excess glycerin to drain.
- Shrink wrap the unit with a thick (1.5 mm) plastic bag and seal membrane unit using a hand sealer or tape.




For long term storage preserved unit should be stored in a cool (4$^0$C - 20$^0$C), dry area, away from direct sunlight and protected from accidental damage.

Re-commissioning the unit is straight forward. Once unit is lowered into MBR Tank, first start the aeration, then the permeate pump. In order to let all the traces of glycerin in the permeate to dissipate, make the arrangement for the permeate to recycle back to the aeration tank for the first half hour.


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## 9.0 SERVICE & SUPPORT

### Commissioning and Start-up

**newterra** MicroClear™ MBR System's **commissioning & start-up** is the last step of the **newterra** project execution process. Experienced engineers and technicians are available to assist clients in these procedures including system initial set up and primary start-up and providing all performance tests according to the pre-commissioning checklist.

**Initial on-site training program** is an important part of the commissioning service as well. During on-site training, **newterra** technical representative will cover process monitoring, system operation, maintenance, and troubleshooting activities related to the **newterra** ™MBR System. Customized training packages are available. Contact **newterra** for more information.

### Post commissioning Services

A comprehensive range of post commissioning services is available from within **newterra** beyond system design and installation. Specific services are included:

- Technical support (including after-hours emergency telephone support).
- Spare parts order and delivery.
- Training program.
- Plant optimization and upgrades.
- Telemetry control and monitoring.
- Assistance in preparing system performance reports (process data monitoring & analysis).
- Preventive maintenance cleaning (including membrane cleaning).
- System audits for reviewing the performance of all MBR subsystems and the efficiency.

1. **Technical support** is available to assist in troubleshooting of **newterra** MBR system during normal working hours 8:30 am to 5:00 pm (Eastern Time Zone for **newterra** ltd.). Telephone service is available via **1.800.420.4056.**

Emergency **24/7 telephone technical support –** This will be activated upon subscribing to **newterra's** 24/7 technical support service.

If problem cannot be resolved through telephone or e-mail supports, **newterra** engineers are available for site visit.


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# Appendix F -
# Steensby and Rail Camps Freshwater Supply, Sewage and Wastewater – Plans for Future Work


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There will be no construction and development of Steensby and the Rail camps in the near future. Updates to these sections of the Plan will be done when required and will be included in a future Annual Report to NWB as required by Part B, Item 4 of existing Type A Water Licence. Block Flow Diagrams for Steensby and Railway Camps will be updated when required.

## A.1 Freshwater

### *A.1.1 Freshwater System Process Description*

A.1.1.1 Steensby Port Site

Currently, there are no construction activities planned for Steensby Inlet. During the future construction phase the on-site population will be approximately 600 people. Half the camp personnel will be accommodated on a barge which will be equipped with potable water treatment systems. The potable system onboard the barge will be a reverse osmosis based system. The full configuration will include coagulation, filtration by media filter, reverse osmosis and chemical disinfection. The remaining personnel will be accommodated by a land based potable water treatment system. This system will continue to operate during the operation phase while the barge based system will only be used during the construction phase.

The existing fresh water equipment will not be used and a new fresh water distribution system will be installed. The fresh water demand for construction and operation are shown on the drawing Steensby Site - Water Supply Balance Block Flow Diagram in Appendix C.

For the land based system, a heated and insulated pump house will be built at Lake ST347 with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression, stockpile dust suppression, concrete and explosives manufacturing will be provided directly from nearby lakes using a vacuum truck.

The land based potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine. The barge based potable water treatment scheme will include the same equipment as well as a membrane based system to desalinate the seawater source.

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#### A.1.1.2 Mid-Rail Site

Currently, there are no construction activities planned for the Mid-Rail Site. During the future construction phase, the on-site population will be approximately 200 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Mid-Rail - Water Supply Balance Block Flow Diagram in Appendix C.

A heated and insulated pump house will be built at an adjacent Unnamed Lake with duty/standby pumps to deliver fresh water to a fresh water tank during summer. During the winter, water will be trucked from Ravn Camp Lake to the fresh water tank. This tank will be located in close proximity to the new potable water treatment plant. Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by vacuum truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

#### A.1.1.3 Ravn River Site

Currently, there are no construction activities planned for the Mid-Rail Site. During the future construction phase, the on-site population will be approximately 400 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Ravn River - Water Supply Balance Block Flow Diagram in Appendix C.

A heated and insulated pump house will be built at Ravn Camp Lake with duty/standby pumps to deliver fresh water to a fresh water tank (to be located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by vacuum truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

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A.1.1.4 Cockburn Tunnels Camp Site (Cockburn North Camp)

Currently, there are no construction activities planned for the Cockburn Tunnels Camp Site. During the future construction phase, the on-site population will be approximately 100 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Cockburn Lake Tunnels Camp - Water Supply Balance Block Flow Diagram in Appendix C.

A heated and insulated pump house will be built at Cockburn Lake with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by vacuum truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

A.1.1.5 Cockburn South Camp Site

Currently, there are no construction activities planned for the Cockburn South Camp Site. During the future construction phase, the on-site population will be approximately 400 people. A new potable water treatment system and fresh water distribution system will be put in place to support the construction phase operations. The fresh water demand for construction and operation are shown on the drawing Cockburn South - Water Supply Balance Block Flow Diagram in Appendix C.

A heated and insulated pump house will be built at Cockburn Lake with duty/standby pumps to deliver fresh water to a fresh water tank (located in close proximity to the new potable water treatment plant). Water from this tank will be used to provide fire water as well as meet the fresh water requirements of the site. A stand pipe within the tank will ensure that fire water is always available in the tank. Some fresh water requirements such as road dust suppression and tunnel drilling will be provided directly from nearby lakes by truck.

The potable water treatment scheme will consist of coagulation followed by media filtration and disinfection by ultraviolet radiation. The water will then undergo a secondary disinfection by sodium hypochlorite injection to ensure residual chlorine content at the point of use. The applicable guidelines specify minimum required levels of chlorine residual free chlorine.

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## A.2 Sewage Treatment

### *A.2.1 Sewage Treatment Process Description*

A.2.1.1 Steensby Site

During the construction and operation phase the camp population will increase to approximately 600 people. There is no planned construction at Steensby Site in the immediate future.

During construction start-up, sewage generated by the workforce will be treated in an existing sewage treatment plant that is on-site but not yet installed. During the construction phase, 300 people will be accommodated by a temporary sewage treatment system in place for the construction period. In addition, the temporary sewage treatment plant will be designed to process raw or partially treated sewage from the Cockburn Lake rail camps which will be conveyed to the Steensby temporary sewage treatment facility by truck. The remaining workforce will be accommodated by a permanent sewage treatment system which will remain in service during the operation phase.

These sewage treatment plants will be housed in a temperature controlled areas and as such their performance will not be negatively impacted by arctic conditions.

Effluent from the sewage treatment plants will be stored in effluent tanks. The effluent tanks will have a hydraulic retention time of two days (at minimum) based upon nominal flows. It is intended that the effluent tank will be at a low level during operation such that if sampling indicates that the effluent quality does not meet the applicable criteria further discharge can be prevented for a period in excess of a day to allow this effluent to be mixed, retreated, and retested. In addition this retention volume will allow for a minimal amount of recirculation through the STP using any spare STP capacity. This will improve the quality of the final effluent in the tank. The volume is sufficient to allow for periodic sampling and testing of the treated effluent before discharge or reuse. The new permanent sewage treatment facility will be RBC based technology or superior. Treated effluent will be discharged to the ocean.

The equalization tank that feeds the temporary sewage treatment plant will be sized to accommodate the sewage from the Cockburn Lake and Cockburn South rail camps. The rail camp sewage will be added during periods of low sewage generation at Steensby in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary. The incinerator design will consider the solids content of the sludge from the dewatering device.

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The equalization tank that feeds the new sewage treatment plant will be sized to accommodate the sewage from the Cockburn Lake and Cockburn South rail camps. The rail camp sewage will be added during periods of low sewage generation at Steensby in order to reduce excessive surge volumes building up in the tank.

The sludge generated will be dewatered using a mechanical dewatering device such as belt filter or filter press and then incinerated. Sludge cake will be stored in an animal proof secure area. Odour generation will be limited because the sludge will be aerobically digested, dewatered and incinerated regularly such that the sewage cake is not stored for significant periods. Odour control carbon vents will be installed where deemed necessary.

#### A.2.1.2 Mid-Rail and Ravn River Sites

Sewage waste generated at the Ravn River and Mid-Rail camps and Sewage generated at the Cockburn North and Cockburn South camps can only be transported and treated at either the Mine Site Sewage Treatment Facility or the Steensby Port Sewage Treatment Facility, unless otherwise approved by the Board in writing.

Sewage generated at these sites will mainly be conveyed to the Mary River permanent sewage treatment facility by truck. During the first year when there will only be access to the camp via an ice road, sewage can only be trucked from January to April. During the remaining months the sewage will be stored. There would be an opportunity to partially or fully treat sewage prior to storage. Sewage storage facilities may be aerated to prevent the waste from becoming septic (generating odours and noxious gases). Sludge will form and settle in the facility depending on how long the sewage resides there. This sludge will be withdrawn and delivered separately to the dewatering system at the Mine Site. Given the quantity of waste to be moved or stored every effort will be made to reduce this volume by using low flow showers and toilets and potentially segregating gray water to be treated and reused as urinal flush water. Other potential waste minimization techniques will also be reviewed. These will be evaluated during the detailed design. In addition, the surrounding water bodies will be modelled and sampled to potentially support having sewage treatment and waste discharge near the camp sites. An additional amendment to the Type A Water Licence would be required to support this option.

The equalization tank at Mary River will be sized to provide sufficient residence time for freshly added sewage from the Mid-Rail or Ravn River to mix with sewage generated at the Mine Site. Given that sewage generation follows diurnal patterns the sewage from the remote sites will be added during the low generation periods at the Mine Site.

#### A.2.1.3 Cockburn Tunnels (Cockburn North) and Cockburn South Sites

Sewage generated at these sites will be conveyed to the Steensby permanent sewage treatment facility by truck. Raw to partially treated sewage will be conveyed to Steensby Inlet by means of established roads along the rail alignment or by ice road. Depending on the volume of sewage to be stored at site, the

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sewage storage facilities will be sized accordingly. At the north camp there will only be access to the camp via an ice road and as such sewage can only be trucked from January to April. During the remaining months the sewage will be stored. Sewage storage facilities will be aerated to prevent the waste from becoming septic (generating odours and noxious gases). There will be the opportunity to partially or fully treat sewage prior to storage. Sludge will form and settle in the facility depending on how long the sewage resides there. This sludge will be withdrawn and delivered separately to the dewatering system at the Steensby site. Given the quantity of waste to be moved every effort will be made to reduce this volume by using low flow showers and toilets and potentially segregating gray water to be treated and reused as urinal flush water. Other potential waste minimization techniques will also be reviewed. These will be evaluated during the detailed design. In addition, the surrounding water bodies will be modelled and sampled to potentially support having sewage treatment and waste discharge near the camp sites. An additional amendment to the Type A Water Licence would be required to support this option.

The equalization tank at Steensby will be sized to provide sufficient residence time for freshly added sewage from the Cockburn Tunnels (Cockburn North) and Cockburn South camps to mix with sewage generated at the Steensby site. Given that sewage generation follows diurnal patterns the sewage from the remote sites will be added during the low generation periods at the Steensby site.

#### A.2.1.4 Design Considerations from 'Lessons Learned'

Previous studies have recommended the use of Polishing Waste Stabilization Ponds (i.e. Mary River Project Appendix 10D-3 Wastewater Management Plan SD-EMMP-003, March 31, 2010) followed by a secondary waste polishing system. The existing infrastructure at the Mine Site and Milne Port include these ponds in part to allow for secondary treatment of the sewage treatment plant (STP) effluent which was not meeting the phosphorus discharge limit. However, based upon practical experience at the site with the STP it was projected that a secondary polishing system will not be required in the future.

The new systems will be installed with temporary storage ponds for off-spec water but will not require secondary polishing for the following reasons:

- The proposed new STPs will be based on membrane technology. This technology produces better quality effluent, is less susceptible to the impact of varying loads and has shorter start-up periods.
- The STP trains will be better able to handle upsets by using the available spare capacity to operate the equipment at more conservative flow rates.
- The existing equipment (at the Mine Site) was designed to meet a phosphorus discharge criterion of 0.5 mg/L. The new STPs shall be designed to meet a much lower phosphorus discharge criteria of <0.1 mg/L.

Sewage Treatment equipment vendors will be assessed based upon their experience producing equipment for arctic environments.

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### *A.2.2 Oily Water/Wastewater Treatment Process Description*

The process descriptions for both oily water/wastewater treatment systems for Steensby are described in the section that follows.

#### A.2.2.1 Steensby Site

**Future Construction and Operation Phase**

Oily water may be generated from the following sources (this neglects minor oily water generated from accidental spills which will be handled by the Spill Response Plan):

- Vehicle maintenance and wash facilities (i.e. truck wash, equipment and floor wash down water).
- Fuel tank farm run-off.
- Emulsion plant wash water.
- Freight dock.
- Airstrip.

The vehicle maintenance and wash facility will have a sump located in close proximity to the maintenance facilities. Wash water produced in the maintenance facility (truck washing, equipment and floor washdown) will flow by gravity and be collected in the local sump. Suspended material in the wastewater will settle in the sump. Free oil in the wastewater will be removed by an oil/water separator system in order to meet the required oil discharge limits. The waste will then be further treated in the oily water treatment plant by activated carbon and clay to meet other specific parameters. The effluent will then be pH adjusted, if required, to meet discharge criteria.

Treated effluent from the oily water treatment plant will be pumped to discharge, or recycled and reused as washdown water at the maintenance shops. The separated waste oil will be stored in a local tank. Periodically, the oil will be drained and shipped off site or incinerated. Accumulated suspended solids will be periodically removed and sent to the landfarm for treatment, if necessary.

Run-off from the tank fuel storage areas will have to be treated by the mobile oily water separator system that will be used as needed. The resulting water will be discharged directly to the receiving body (Steensby – Ocean). The water will be periodically tested such that if any parameter is out of compliance the water will be removed by vacuum truck and treated in the vehicle maintenance shop wastewater treatment plant.

Run-off water from the freight dock will be collected and treated in a manner similar to the treatment scheme for the run-off from the tank fuel storage areas.

The emulsion plant shall be supplied with its own wastewater treatment plant which utilizes an evaporation system to evaporate the water leaving solid residue and oil. This residue will be tested for

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toxicity and if necessary taken off-site for disposal at a licensed facility otherwise the waste will be land filled.

Run-off water from the air strip run-off also has the potential for some oily water content. As such, this water will be collected through a drainage system and transported as needed by vacuum truck to the vehicle maintenance shop wastewater treatment plant.

Small amounts of propylene glycol will be used for de-icing of aircraft. The spent propylene glycol will be collected, stored in containers and sent by ship off-site to a licensed treatment/disposal facility. Some interim treatment of the spent propylene glycol may occur to reduce the overall waste volume generated. This will be evaluated during the detailed design.

Some dust suppression solution will be applied to roads at the Steensby site. The suppressant will be DL-10. This is an asphalt based emulsion and as such some water will be consumed for the dilution of the solution. This is an approved dust suppressant as specified by the Nunavut Department of Sustainable Development Environmental Protection Service (Environmental Guideline for Dust Suppression).

In addition, some Calcium Chloride solution will be used for drilling activities. The spent brine will be applied to nearby roads as a dust suppressant. This is an approved dust suppressant as specified by the Nunavut Environmental Protection Service. Treated oily water will be blended with treated sewage and discharged or discharged directly based on sampling.

#### A.2.2.2 Rail Camps

Two tunnels are to be built along the railway and a small amount of water will be consumed in the tunnelling operation. Calcium Chloride brine solution is used for tunnelling. This waste brine generated during the tunnelling will be collected and disposed of as per the Waste Management Plan for Construction, Operation and Closure. In addition, some Calcium Chloride solution will be used for drilling activities.

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# Appendix G - Polishing Waste Stabilization Ponds (PWSP) Effluent Discharge Plan

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# Technical Memo

**To:** Connor Devereaux, Baffinland Iron Mines

**From:** Jack Hinds, P.Eng, Wood E&IS

**Reviewer:** Jered Munro, P.Eng, Wood E&IS

**Project No.:** TPC192071

**Date:** 29 April 2020

**Re:** PWSP Treatment and Discharge

## 1.0 Background

Baffinland Iron Mines Corporation (Baffinland) has retained Wood Environment and Infrastructure Solutions, a Division of Wood Canada Ltd (Wood E&IS) to prepare this technical memo, outlining treatment, and disposal options for the water stored in the polishing/ waste stabilization ponds (PWSPs) at the Milne Inlet and Mary River sites.

The PWSPs can receive wastewater, sludge, grey water, and non-compliant sanitary effluent from various locations across both sites. These sources include, but are not limited to:

- Non-compliant effluent from wastewater treatment plants
- Excess sludge generated at wastewater treatment plants
- Raw sewage from spills
- Raw sewage from lift stations as a result of malfunction or emergency
- Greywater from lift stations

This plan updates and amends the previous plan that was completed in March 2012. The intent of this memorandum is to outline options that could be employed to treat the PWSPs to a level that is compliant with the approved Type A Water Licence requirements and be discharged to the environment under those requirements. The proposed treatment options may be used individually or combined with other treatment options to form a treatment system that is capable of achieving compliant effluent quality. This approach has been selected to provide operators with the ability to address various water quality issues that can occur due to changing conditions in the PWSPs, caused by the various site sources noted above, and the natural environment.

The PWSPs can potentially require treatment for:

- Removal of BOD/COD
- Removal of total suspended solids (TSS)
- Removal of total ammonia
- Removal of total phosphorus
- Removal of oil and grease
- Destruction of faecal coliforms
- Acute Toxicity associated with inorganic or organic compounds
- Control of pH

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Registered in Canada No. 773289-9; GST: 899879050 RT0008; DUNS: 25-362-6642

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## 1.1 Onsite Water/Wastewater Treatment Equipment

There are a number of water and wastewater treatment equipment available at the Project site that are available for use in treating the PWSPs. The equipment is owned and maintained by Baffinland, and is typically operated by Baffinland, or is operated under contract with an engineering or operations firm. It is expected that Baffinland may be required to purchase additional equipment or replace existing equipment that is aging or no longer functional.

Baffinland maintains a supply of common treatment chemicals required by the treatment processes. Less common chemicals used for treatment are brought on site on an as-needed basis.

# 2.0 Treatment of PWSPs

PWSP treatment occurs during the spring and summer discharge seasons, when the water in these ponds is not frozen. Water quality in the PWSPs can be variable, and often changes over the course of the year. These variations in water quality are typically caused by:

- Contributions of impacted water to the PWSPs
- Spring melt, and ice retained within the PWSPs
- Fluctuations in temperature and pH
- Biological activity and consumption of nutrients
- Diurnal effects, exacerbated by long periods of daylight/twilight during the mid-summer months

The treatment methods presented below represent the treatment techniques that may be employed to achieve compliant water quality in the PWSPs, and allow for discharge to the environment. The options presented have been listed discretely but may be combined as required in order to address the influent water quality. As the water quality is variable over the course of a single season, multiple treatment methods or approaches may be required in a single season in order to maintain compliant effluent quality.

## 2.1 Winter Discharge

During the winter season, the PWSPs will stratify and eventually freeze the entire water column down to the lined bottom of the pond. If no additional non-compliant effluent is added to the ponds, it is possible that melted ice could be compliant for discharge. This offers Baffinland an opportunity to perform a discharge during winter months, if additional storage space is required before the spring melt.

To do so, Baffinland would use in-line heaters to recirculate hot water into the pond, to produce a layer of melt water. The melt water would then be heated, and returned to the pond, to further melt the surface ice. This process would be repeated, until there was sufficient free water on the surface to allow for sampling and discharge.

Samples will be collected for all criteria and analyzed prior to discharge. The discharge will be monitored for compliance following the guidelines given in Section 3.0, and will be shut down once water quality degrades below internally set limits.

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## 2.2 Spring Discharge

As noted in Section 2.1 above, during the winter months the PWSPs will typically freeze down to the lined bottom of the ponds. During spring freshet, warmer temperatures and increased daylight hours cause the top layer of ice to thaw first, creating a pool of clear water on the surface of the PWSPs.

Typically, this initial melt water is compliant for discharge due to settling of solids at the end of the previous season. If the water quality analysis confirms the meltwater is compliant, it may be discharged to the receiving environment without further treatment.

The discharge will be monitored for compliance following the guidelines given in Section 3.0.

## 2.3 Membrane Bioreactor Treatment

Baffinland owns and operates Membrane Bioreactors (MBRs) for treatment of sewage at both the Mary River and Milne Inlet sites. If there is available capacity in these plants, impacted water from the PWSPs may be treated through the installed MBRs. This may be achieved either through the use of a vac-truck offloading to the equalization tank, or through installation of a temporary or permanent pumped line to the equalization tanks. Appropriate controls would be installed to ensure the total volume of pond water treated is controlled and recorded, and the equalization tank and MBR treatment system are adequately protected from damage.

An alternate approach that could be considered by Baffinland is to install a package treatment process specifically for the PWSPs. In this case, impacted water from the ponds will be pumped directly into the equalization tank, and treated through the system.

Generally, a package treatment system is comprised of the following processes:

- Equalization tank and pumps
- Coarse filtration system
- Aeration tank, with aeration grid and blowers
- Biological treatment process, including membranes or media, blowers, backwash system, cleaning system etc.
- Sludge pumps and sludge storage
- Sludge handling system, such as a sludge press
- Final effluent holding tank and pumps
- Disinfection system
- Chemical dosing systems

### 2.3.1 Filter Cake Disposal

Filtered sludge cake generated by the biological treatment process is either incinerated onsite, or backhauled south for disposal at an approved facility. All sludge cake will be handled in accordance with the applicable portions of Baffinland's Fresh Water Supply, Sewage, and Wastewater Management Plan.

## 2.4 Dissolved Air Flotation

Dissolved Air Flotation (DAF) is a treatment principle typically used to remove solid materials from wastewater, through the use of a recycle stream of air-saturated liquid. Baffinland may employ owned, constructed, or rental DAF units at either site for treatment of the PWSPs. DAF systems typically only remove solid material in the water, making them applicable for removal of BOD, TSS, and total phosphorus.

Wastewater is pumped into the system from the source, through a tube flocculator where coagulation and flocculation chemicals are added prior to entering the main treatment tank through a distribution header. A recycle pump draws a stream of partially-clarified liquid off the side of the tank and pressurizes it in an air saturation tank. At the same time, compressed air is injected into the air saturation tank, creating a recycle stream saturated with dissolved air. This recycle stream is then released back into the main tank, where the saturated air comes out of solution as very fine air bubbles. These bubbles act as nuclei for flocculated/coagulated solids, causing them to rise to the surface. A skimmer transfers floated solids from the

surface of the tank to a hopper, where it's pumped to a tote or tank for storage and disposal. Clarified effluent flows over a weir and out of the system.

Generally, a DAF system is comprised of the following processes:

- Influent pump
- Tube flocculator
- Dissolved air floatation tank, with distribution headers
- Compressor
- Air control panel
- Air saturation tank
- Recycle pump
- Float skimmer and hopper
- Float pump
- Effluent weir
- Solids drain
- Effluent break tank or holding tank, and pumps
- Chemical dosing system

For coagulation, a DAF system may use the following chemicals:

- Aluminum sulfate (alum)
- Poly-aluminum chloride (PAC)
- Sodium aluminate
- Alum potash
- Ferric/ferrous sulfate
- Ferric chloride
- Lime/soda ash
- Caustic soda

For flocculation, a DAF system may use the following chemicals:

- Vendor-specific, proprietary anionic or cationic polymers

### 2.4.1 Separated Solids Handling

Solids removed from the water by the flotation system are pumped into totes or other appropriate containers, labelled and manifested appropriately, and backhauled seasonally for disposal.

If possible, the floated solids may also be pressed through a filter press and incinerated, if the composition and water content allow.

## 2.5 Bulk Pond Treatment

If required, removal of TSS, BOD, total phosphorus, total ammonia, and/or faecal coliforms, may be performed in the ponds themselves. Doing so allows for rapid, bulk treatment of the contents of the PWSPs.

A typical treatment system would require:

- A pond mixing system
- Chemical dosing systems
- Inline mixers, such as a mixing tank, tube flocculator, or static mixer
- Flowmeter for flow measurement and totalization

Jar testing would be completed on the raw contents of the PWSP being treated to determine approximate chemical dosing rates required for treatment. The ponds would be mixed and chemicals would be injected into the mixing streams in accordance with dosing rates established during the jar tests. Chemical addition may be completed in multiple steps, to ensure no chemical is dosed beyond what is required for treatment.

Once dosing is complete, the PWSP will continue to be mixed for an appropriate amount of time, to ensure the chemical(s) reacts fully and all contents of the pond have been turned over. Once mixing is complete, the mixing system will be shut off, to allow any coagulated/flocculated solids to settle, or to allow for natural stripping

processes to occur. An effluent discharge system will be set up to allow for recirculation of effluent back into the PWSP. When water quality analyses confirm the clarified water is compliant for discharge, discharge may begin.

For in-pond treatment, the following chemicals may be used:

- Aluminum sulfate (alum)
- Poly-aluminum chloride (PAC)
- Sodium aluminate
- Alum potash
- Ferric/ferrous sulfate
- Ferric chloride
- Lime/soda ash
- Caustic soda
- Vendor-specific, proprietary anionic or cationic polymers
- Sulfuric acid
- Citric acid
- Hydrochloric acid
- Phosphoric acid
- Nitric acid
- Sodium hydroxide
- Sodium bicarbonate
- Magnesium hydroxide

### 2.5.1 Settled Solids Handling

Solids removed as part of this treatment method will naturally settle to the bottom of the ponds. Based on observations made in previous years, the quantities of settled solids are low enough to be considered insignificant in comparison to the total storage volume of the pond. Any settled solids typically remain settled and degrade naturally over time. If necessary, Baffinland may elect to drain any one of the ponds and remove and dewater any sludge remaining in the bottom.

## 2.6 pH Adjustment

pH adjustment may be required as a standalone treatment or may be required as part of a larger treatment system in order to maintain compliance. pH adjustment can be carried out in-pond or adjusted inline prior to discharge, depending on the requirements of the system and the condition of the PWSPs.

A typical pH adjustment system could require:

- A pond mixing system
- Chemical dosing systems
- Temporary chemical storage
- Inline mixers, such as a mixing tank, tube flocculator, or static mixer

Past observations suggest that pH in the PWSPs can be acidic, neutral, or basic, depending on what has been contributed to the pond, and what kind of natural biological activity has occurred. Various other treatment methods listed here may also have an impact on effluent pH and may require that pH adjustment be added as part of the treatment process to ensure compliant effluent.

The following chemicals may be used to form part of a pH adjustment system:

- Aluminum sulfate (alum)
- Poly-aluminum chloride (PAC)
- Sodium aluminate
- Alum potash
- Ferric/ferrous sulfate
- Ferric chloride
- Lime/soda ash
- Caustic soda
- Sulfuric acid
- Citric acid

- Hydrochloric acid
- Phosphoric acid
- Nitric acid
- Sodium hydroxide
- Sodium bicarbonate
- Magnesium hydroxide

## 2.7 Filtration

Filtration systems provide a physical barrier, allowing for the removal of solid matter from a liquid stream. Doing so may be an effective means of reducing/removing TSS, BOD, and total phosphorus. Filtration may be used as a standalone treatment process or as part of a larger treatment system. Solids removal through filtration can also be used as tertiary treatment when combined with other treatment processes, to protect against carry-over or suspended solids.

A typical solids filtration system may employ one or more of the following technologies:

- Basket strainers
- Bag filters
- Disposable cartridge filters
- Backwashing cartridge filters
- Sand filters
- Continuous backwash sand filters
- Multimedia filters
- Rotary drum screens
- Belt filters
- Microfiltration
- Ultrafiltration
- Nanofiltration
- Membrane filtration

Filters used either alone, or in conjunction with other treatment processes, may be stand-alone, skid mounted, packaged, or contained within their own seacan.

### 2.7.1 Filtered Solids Handling

For most cartridge or bag filtration systems, solids are removed through capture on a fiber media, which cannot be backwashed. The media must be removed and disposed of according to Baffinland's Waste Management Plan.

Effluent from the backwashing of filters may be directed back into the PWSPs, or into dedicated storage for further treatment or disposal.

## 2.8 Adsorption Media Treatment

For treatment of dissolved compounds in impounded waters, various forms of adsorption media can be employed. The media would be loaded into plastic or steel media vessels and connected to the remainder of a constructed system using hoses. Various types of media may be used in series to remove different contaminants of concern. Media that may be used include:

- Granular activated carbon (GAC)
- Synthetic ion exchange resins
- Activated iron products
- Natural Zeolites
- Other adsorptive and ion exchange media as applicable

Use of adsorption media is typically sensitive to solids in the water, and may become fouled if solids concentrations are too high. Typically adsorption vessels would be preceded by a suitably selected filtration process to prevent fouling.

## 2.9 Oxidation

Some of the chemical treatment approaches listed use an oxidation-reduction reaction to remove contaminants. However, it is sometimes necessary to augment that oxidation reaction to further remove any contaminants, or to remove specific species that are otherwise hard to treat. Most forms of enhanced oxidation require additional

power and would be purpose-built systems constructed or purchased from vendors and brought to site. These could include:

- Hydrogen peroxide addition
- Ozone addition
- Ultraviolet light (UV)
- Electrochemical oxidation

## 2.10 Transfer of Water Between Sites

Under some circumstances, it may be necessary to transfer non-compliant effluent or pond water between sites, to facilitate treatment or provide additional capacity to handle upset conditions. Both sites have separate PWSPs, with different capacities and different available methods of treatment. By transferring water from one site to another, Baffinland can more effectively manage and treat non-compliant effluent, during treatment plant upsets.

Treatment between sites is achieved through the use of vacuum trucks specifically designated for hauling non-compliant effluent. The trucks would transport the water between the PWSPs at both sites, as required to achieve treatment and discharge.

# 3.0 Sampling and Performance Monitoring

The effluent discharge quality criteria for the PWSPs is defined in the Type A Water Licence 2AM-MRY1325 Amendment No. 1 as issued by the Nunavut Water Board, July 31, 2014. The following table summarizes the discharge criteria:

| Parameter | Discharge to Freshwater<br>Max concentration of any grab sample (mg/L) | Discharge to Ocean<br>Max concentration of any grab sample (mg/L |
|---|---|---|
| $BOD_5$ | 30 | 100 |
| TSS | 35 | 120 |
| Faecal Coliforms | 1000 CFU/100 ml | 10,000 CFU/100 ml |
| Oil and Grease | No visible sheen | No visible sheen |
| pH | >6.0, <9.5 | >6.0, <9.5 |
| Ammonia (NH3-N) | 4.0 | NR |
| Total Phosphorus | 1.0 | NR |
| Toxicity[1] | Not acutely toxic | Not acutely toxic |

*1: Acute lethality to rainbow trout (Method EPS/1/RM/13) and daphnia magna (Method EPS/1/RM/14)*

Prior to commencing any treatment or discharge, Baffinland or their contractors will be required to develop and submit a discharge plan including details on monitoring and sampling frequency, safeguards, internal limits, etc. This plan shall be submitted to the Environmental Superintendent for review and approval before any treatment or discharge begins.

Baffinland will complete sampling to confirm treatment efficacy prior to and during discharge, which will be conducted at the intervals specified in the relevant discharge plan and the results of which will be used to guide treatment implementation and the ability to commence or continue discharge to the receiving environment. Discharge samples will be collected in accordance with the schedule laid out in the Type A Water Licence and provided to regulators to confirm treated effluent discharge meets the applicable criteria outlined above.

If there are any questions, comments, or concerns regarding the content of this memo, please feel free to reach out to Jack Hinds at 519-650-7143 or Jered Munro at 519-650-7130.

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# Appendix H - Mobile Oily Water Separator (OWS) Manual

(See BAF-PH1-830-T07-0001)

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# Baffinland Iron Mines Corporation

## Mobile Oily Water Separator (OWS) Manual

## BAF-PH1-830-T07-0001

## Rev 0

**Prepared By:** Andrew Vermeer
**Department:** Environment
**Title:** Environmental Coordinator
**Date:** March 21, 2016

**Signature:** 

**Approved By:** Allan Knight
**Department:** Environment
**Title:** Environmental Superintendent
**Date:** March 21, 2016

**Signature:** 


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# 1 PURPOSE AND SCOPE

The purpose of this manual is to provide guidance for the commissioning, operation, and decommissioning of the mobile oily water separator (OWS) in a safe, efficient and environmentally responsible manner.

# 2 REQUIREMENTS

## 2.1 REGULATIONS

Type A Water Licence No: "2AM–MRY1325 – Amendment No. 1", Nunavut Water Board

Nunavut Mine Health and Safety Act and Regulations.

## 2.2 HAZARDS AND REQUIRED HSE EQUIPMENT

### 2.2.1 HAZARDS

Identified hazards associated with commissioning, operation and decommissioning of the OWS include:

- Working with energized equipment and pressurized lines
- Working with electrically energized equipment near water
- Exposure to contaminated water and hazardous chemicals (i.e. diesel, bentonite)
- Working from heights
- Elevated noise levels (generator)
- Spills

### 2.2.2 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

The following personal protective equipment (PPE) requirements have been assigned to the commissioning, operation and decommissioning of the OWS:

*Standard PPE*

- Hard hat
- Reflective vest
- Safety glasses
- Steel toed boots
- Rubber gloves

*Additional PPE*

- Face respirator and P100 particulate cartridge (for handling bentonite and lead media)
- Rubber gloves and hip waiters (when installing the berm sump)
- Nitrile gloves, safety glasses and lab coat when performing sample analysis

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- Ear protection (when working near generator)

All PPE must comply with applicable Baffinland's PPE policy and be inspected for damage prior to use.

### 2.2.3 Additional Safety and Environmental Equipment

The following safety and environmental equipment should be available at the OWS unit during operation.

- Fire extinguisher
- Spill kit
- Radio
- Spill pads (for fuel and free product tank)
- Quatrex bags (for used bag filters and spent media)

## 2.3 General Safety Instructions

- Monitor all pressure gauges and immediately shut down the OWS system if any exceedances occur
- Watch for pinch-points when exchanging bag filters
- Only trained personnel shall open or work on the electrical panels
- As a precaution against arc flashing, use your left hand and turn your body away from the electrical panel when switching off main breaker to the OWS
- When opening valves to vent air, do so slowly and carefully. Do not stand directly in front of valve.
- Ensure all electrical cords are in good condition and safely secured
- Practice good housekeeping inside and around the OWS unit
- Walk carefully between adsorption units, being careful not to become entangled with hoses or shut off valves by accident
- Wear all required PPE when working at OWS

## 2.4 Training and/or Qualifications

Any person commissioning, operating or decommissioning the OWS at the Project is required to have read and be familiar with this document. All operators will be trained by an experienced operator.

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# 3 DEFINITIONS

**Total Adsorption Tank Bed Volume**: the maximum total volume of water that the three (3) media vessels can hold when full of their respective medias (i.e. GAC, bentonite, anthracite).

**GAC**: granular activated carbon

**GPM**: gallons per minute

**LPC**: liquid phase carbon

**HMI (Human Machine Interface)**: refers to the screen in the OWS control room.

**API:** refers to the baffled tank in the first stage of treatment where free product is removed.

**BTE:** refers to benzene, toluene and ethylbenzene.

# 4 RESPONSIBILITIES

The following responsibilities have been assigned to Baffinland's Environmental and Surface Works Personnel regarding the commissioning, operation and decommissioning of the OWS.

## 4.1 ENVIRONMENTAL COORDINATOR

Under the supervision of the Environmental Superintendent, the Environmental Coordinator will be responsible for implementing this SOP at their Project site. In the absence of the Environmental Coordinator, the Project Site Environmental Lead or his/her designate will assume all responsibilities outlined in this procedure. Specifically, the Environmental Coordinator shall:

- Ensure Environmental staff operating the OWS have read, understand and follow this SOP;
- Review and modify this SOP, as necessary;
- Provide updates to the Environment Superintendent and/or Environment Manager on the status and current operations of the OWS;
- Oversee and supervise all OWS operations;
- Report sample analysis results to the Environment Superintendent and/or Environment Manager.

## 4.2 OPERATORS

Under the supervision of the Environmental Coordinator, OWS operators will be responsible for adhering to and following this manual. Specifically, operators shall:

- Read and adhere to the protocols outlined in this manual
- Wear all required PPE;
- Conduct routine inspections of the OWS work area to ensure adequate controls are in place to mitigate known hazards;

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- Maintain a detailed log of all actions undertaken during operations and record all required data in the Daily Log Sheet (Appendix D);
- Complete required sampling and sample analysis (Section 5.5) to ensure OWS is operating as designed and that the final effluent meets water quality discharge criteria

### 4.3 Surface Works Personnel

Surface Works personnel shall support OWS operations, as necessary. Specifically Surface Works personnel shall:

- Provide a vacuum truck and operator for removing spent media;
- Assist in transporting, relocating and levelling the OWS unit;
- Assist operators in commissioning OWS by providing electrical support regarding power generation and ancillary components (wiring configuration and electrical switches);
- Provide logistical support in transporting barrels, Quatrex bags, supplies and other components to and from the OWS unit, as required.

## 5 PROTOCOL

### 5.1 Oily Water Separator (OWS) Overview

The OWS is a prefabricated system housed in a 40' foot seacan and is designed to remove oil, grease and BTE compounds from wastewater contaminated by hydrocarbons. The unit includes an API type separator to remove free product, a bag filter for solids removal and three adsorption units (one clay and two GAC) for hydrocarbon removal. In the event that the wastewater has lead concentrations that exceed the discharge limits outlined in Baffinland's Type 'A' Water License (2AM-MRY1325 Amendment No. 1), additional treatment barrels containing lead removal media will be added to the end of the OWS system. Refer to Section 5.3 for additional information on configuring the lead treatment barrels.

The OWS unit (Newterra model OWS-24) is sized for a water temperature of 7°C, specific gravity of 0.88 (diesel/furnace oil), TOG concentration of 50mg/L and flow rate of 50 gpm.

**Error! Reference source not found.** shows the Process Flow Diagram for the OWS.

Refer to Appendix A - Section 3 in the Newterra OWS O&M Manual for process and instrumentation drawings These drawings include equipment sizing, valves, and instrumentation as well as equipment/instrument tag and model numbers.

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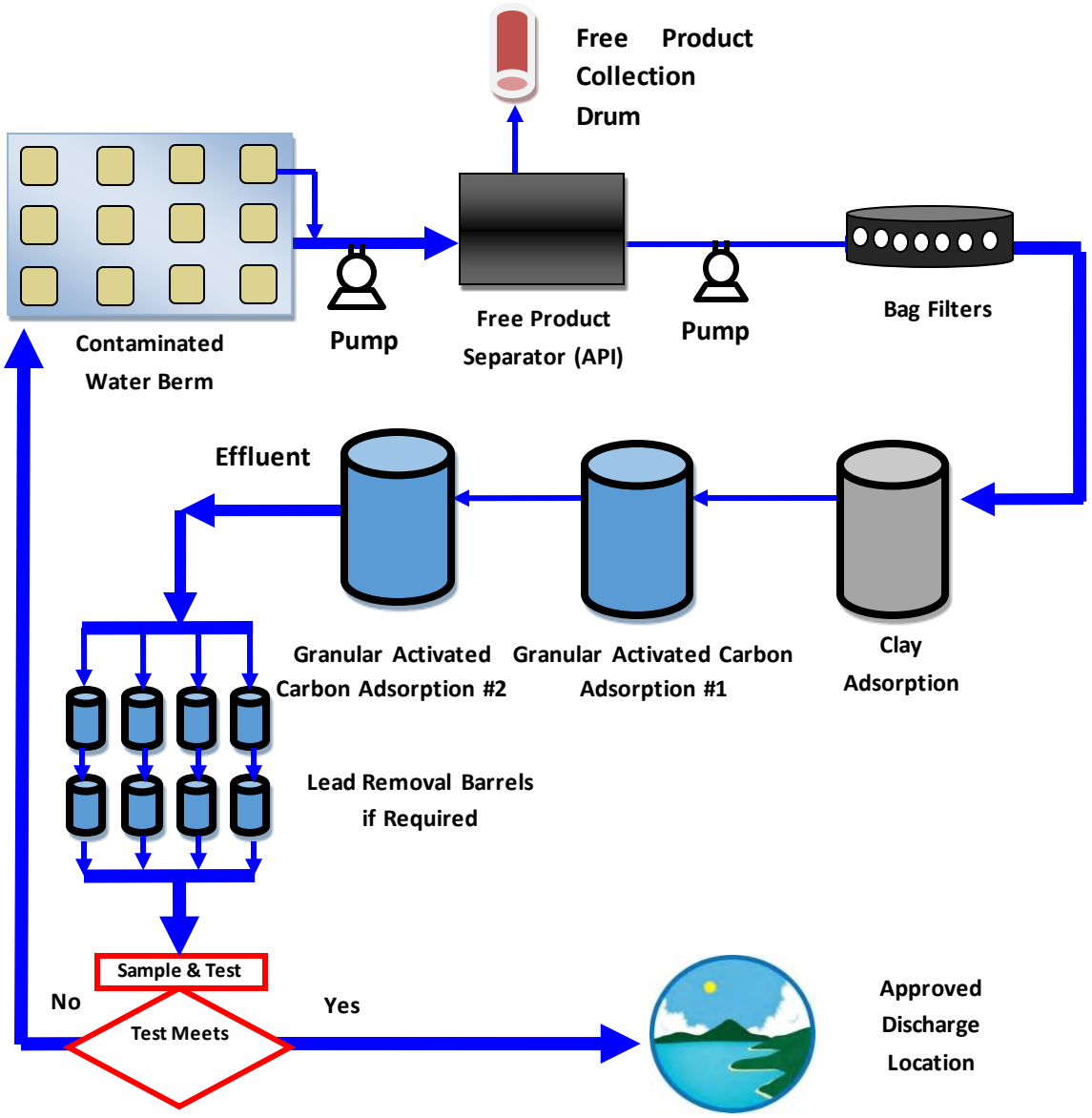



**FIGURE 5-1 – OWS PROCESS FLOW DIAGRAM**

The following protocols discuss in detail how to operate the OWS unit in a safe, efficient and environmentally responsible manner. Protocols discuss the commissioning, decommissioning and general operation procedures of the OWS unit as well as the water quality discharge criteria outlined in Baffinland's Type 'A' Water Licence (2AM-MRY1325 Amendment No. 1).

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## 5.2 Water Quality Discharge Criteria

The main sources of the contaminated water (wastewater) that the mobile OWS unit will be treating are the Bulk Fuel Containment Facilities/Berms and the Landfarm Facilities (including the Contaminated Snow Containment Berms).

All discharges from Bulk Fuel Storage Facilities will not exceed the following effluent quality limits outlined in Table 5-1. Applicable Monitoring Stations include MP-03, MP-MRY-7, MS-03, MS-04, MS-MRY-6, SP-04 and SP-05.

**TABLE 5-1 –** EFFLUENT QUALITY DISCHARGE LIMITS FOR BULK FUEL STORAGE FACILITIES

| Parameter | Maximum Concentration of Any Grab Sample (ug/L) |
|---|---|
| Benzene | 370 |
| Toluene | 2 |
| Ethylbenzene | 90 |
| Total Lead | 1 |
| Oil and Grease | 15,000 and no visible sheen |

*Source: Type A Water Licence (2AM-MRY1325 – Amendment 1) Table 8

All discharges from Landfarm Facilities, including the Contaminated Snow Containment Berms, will not exceed the following effluent quality limits outlined in Table 5-2. Applicable Monitoring Stations include MP-04, MS-05 and SP-06.

**TABLE 5-2** – EFFLUENT QUALITY DISCHARGE LIMITS FOR LANDFARM FACILITIES

| Parameter | Maximum Concentration of Any Grab Sample (ug/L) |
|---|---|
| pH | Between 6.0 and 9.0 |
| TSS | 15 |
| Oil and Grease | 15,000 and no visible sheen |
| Total Lead | 1 |
| Benzene | 370 |
| Toluene | 2 |
| Ethylbenzene | 90 |

*Source: Type A Water Licence (2AM-MRY1325 – Amendment 1) Table 9

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## 5.3 Commissioning the Oily Water Separator

Prior to commissioning the OWS, operators should review the OWS Commissioning Job Hazard Analysis (JHA) presented in Appendix B and inventory all chemicals/equipment required for OWS operation, including the supplies needed for sampling and conducting internal sample analysis.

As previously mentioned, the OWS system is a treatment train comprised of an API separator, a bag filter and three adsorption media vessels (tanks). The first process in the system's treatment train is the API separator which separates free-floating product with a skimmer and densely emulsified product with coarse screen filters. After the API separator, contaminated water is put through a bag filter unit to remove solids and is then percolated through three adsorption media tanks to remove any remaining hydrocarbon fractions. The first adsorption tank contains clay media comprised of two chemicals: anthracite and bentonite. Anthracite is a course media which is added to the tank first so that the anthracite is located at the bottom of the tank near the outlets. Anthracite is added first to prevent the finer bentonite media (added after the anthracite) from clogging the outlet filters located at the bottom of the tank. Following the clay adsorption tank, the second and third adsorption tanks are referred to as the GAC (LPC) tanks and are filled entirely with granulated activated carbon (GAC).

Table 5-3 provides the media types used in the OWS adsorption media tanks and their respective quantities.

**TABLE 5-3** – ADSORPTION TANK MEDIAS AND QUANTITIES

| OWS Adsorption Tank | Media Type | Quantity | # of bags/boxes |
|---|---|---|---|
| Clay (Tank 1) | Anthracite (added first and is utilized as course media around the outlet ports at the bottom of the tank) | 1,000 lbs | 18 |
| Clay (Tank 1) | Bentonite | 5000 lbs | 103 |
| GAC #1 (Tank 2) | Granulated Activated Carbon | 3000 lbs | 54.5 |
| GAC #2 (Tank 3) | Granulated Activated Carbon | 3000 lbs | 54.5 |
| Lead media (2 barrels per train, 3-4 trains in parallel) | Metsorb HMRG | 3.5 cubic feet | 3.5 |

Before commissioning the OWS system for the upcoming season, the influent and effluent TOG results from the previous year's treatment records should be assessed to determine if the existing media in the

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OWS adsorption tanks needs to be replaced. Percent removals for each applicable parameter (i.e. BTE, TOG, lead, etc.) should be calculated using the previous year's influent and effluent analysis results just prior to the previous year's winterization/decommissioning of the OWS system.

$$\text{Percent removal} = \frac{Conc\ influent\ -\ Conc\ effluent}{100}$$

The media is completely spent (used) and will need to be replaced when the influent concentration is equal to the effluent concentration (i.e. percent removal = 0%). The percent removal is used to assess and determine whether the media is capable of effectively treating current hydrocarbon concentrations found in the wastewater to be treated. The media will need to be replaced if the percent removal is not sufficient to reduce the contaminants concentrations below the discharge requirements outlined in Section 5.2. Contact Environmental Coordinator for direction if unsure.

The following steps are required to replace media from the adsorption media tanks:

1. Review JHA (Appendix B) with supervisor. Modify JHA, if necessary.
2. Wear all appropriate PPE (including respirator and P100 particulate cartridge)
3. Remove lids from adsorption tanks.
4. Contact Surface Works to provide vacuum truck to remove media from tanks.
5. Transfer spent media into labelled Quatrex bags (white).
6. Refill tanks with quantities listed in Table 5-3.
   ***Note:*** *Bentonite contains silica dust which is carcinogenic and therefore requires personnel to wear a half mask respirator equipped with a P100 particulate cartridge when handling bentonite. Refer to MSDS for full instructions before handling or opening bags.*
7. Reattach adsorption tank lids.

Whether the existing media from the previous year or brand new media is being used, the media in the adsorption tanks must be soaked in clean freshwater for 24 hours prior to running contaminated water through the system. This allows air trapped in the media's pores to be removed and the full surface area of the media to be utilized in treatment.

The following steps are required to soak the media within the adsorption tanks:

1. Contact Surface Works to provide a water truck with a full load of freshwater.
2. Open up all inlet and outlet valves on adsorption tanks except the outlet valve on the last adsorption tank (GAC#2). This will allow water to equalize among all three adsorption tanks
3. Open pressure valves on the top of each adsorption tank for air venting.
4. Hook up water line to inlet of the first adsorption tank.
5. Begin pumping water into the adsorption tanks using water truck. Ensure water truck pump is throttled to its lowest setting.
6. As tanks fill, use a rubber mallet to hit around the circumference of each tank to release any remaining air.

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7. Monitor pressure valves on adsorption tanks and ensure tank pressures **NEVER exceed 40 psi.** If necessary, shut off water truck periodically to allow pressure to release and equalize among tanks.
8. Shut off top pressure valves on each adsorption tank once water begins to come out of the each valve.
9. Shut off water truck once water has come out of each adsorption tank's top pressure valve.
10. Allow media to soak for 24 hours.

The OWS does not have its own power supply and therefore will need to be hooked up to a diesel generator to operate. For a generator and fuel tank, contact Surface Works. Refer to the Newterra OWS manual presented in Appendix A for engineered drawings and detailed instructions on how to hook-up the power line/supply, sump pump, water level float and free-product float.

Prior to starting the OWS unit, the wastewater to be treated (influent) should be sampled and analyzed internally to confirm the OWS unit is able to treat the hydrocarbon (TOG) levels found in the wastewater. If TOG levels are determined to be greater than 120 mg/L, contact the Environmental Coordinator for instruction.

Prior to discharging treated effluent from the OWS to the receiving environment, contaminated water should be re-circulated between the OWS unit and the wastewater containment berm. This is done to (1) flush out the freshwater used to soak the media in the adsorption tanks and (2) confirm the treated effluent discharged from the OWS meets the water quality discharge criteria outlined in Section 5.2 Approximately 10 $m^3$ (2640 USG) of wastewater must be recirculated through the OWS unit to flush the system of freshwater and confirm effluent quality.

Once the freshwater has been flushed out of the system, effluent samples can be collected for internal and external analysis. External effluent samples should collected and tested for all parameters required by the facility's effluent discharge criteria presented in Section 5.2. Internal samples should be taken in parallel to external samples and tested for TOG on-site using the procedure outlined in Section 5.5.3.

If after receiving the external analysis results, it is determined that lead treatment barrels will be required to ensure that the treated effluent meets the facility's discharge criteria, barrels will be setup following the third adsorption tank (GAC#2) of the OWS. Lead media barrels are typically configured into four trains in parallel with each train made of two barrels hooked up in series. The number of trains used is the limiting factor that determines the overall flow rate that can pass through the system, with each train having an approximate flow rate of 5 gpm. Each lead media barrel is equipped with a pressure gauge and water vent at the inlet valve located at the top of the barrel and an outlet valve at the bottom of the barrel. The effluent manifold should be placed at a higher elevation than the barrels to ensure barrels remain flooded when system is off. Air should be purged from the system upon start up. For more details on how to configure the lead treatment barrels and replace the lead removing media refer to Section 5.4.8.

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**Do NOT discharge any treated effluent from the OWS system to the receiving environment unless it has been authorized by the Environmental Manager.**

## 5.4 Operation and Maintenance Procedures

The following procedures provide detail on how to safely operate and monitor the mobile OWS system. Prior to operating the OWS, all operators should review the OWS Operation JHA presented in Appendix C.

### 5.4.1 Target Operating Conditions

The following table outlines the initial target operating conditions:

**TABLE 5-4 – INITIAL OPERATING TARGETS**

| Parameter | Units | Initial Target |
|---|---|---|
| Flow rate from Pump 4901 (FQI 7001) without Lead Treatment trains. | gpm | 45-50 |
| Flow rate from Pump 4901 (FQI 7001) with four (4) Lead Treatment trains. | gpm | 15-20 |
| Discharge Pressure of Pump 4901 (PI 4901) | psi | 55 |
| Max Bag Filter Inlet Pressure (PI 6701) | psi | 40 |
| Max Adsorption Unit Inlet Pressure (PI 7001) | psi | 40 |
| Max Lead Treatment Barrel Inlet Pressure | psi | 10 |

### 5.4.2 System Start-up

1. Turn generator **ON** if not already running. Ensure sufficient oil in generator and diesel in fuel tank. **Note:** All operators must be trained by Surface Works electricians on the proper starting and fueling procedures when operating the OWS system.
2. Ensure electrical panel is securely closed/locked. **Note:** Only trained personnel should open and adjust breakers in electrical panel.
3. Turn **ON** main disconnect for power to the OWS if not already on. **DO NOT** stand directly in front of panel when turning **ON** or **OFF** main disconnect.
4. The HMI screen will display system status and active alarms. Scroll right or left to view the active alarms. Address any alarms present. Refer to Section 3 of the Newterra O&M Manual presented in Appendix A for a list of alarms and activation/deactivation conditions.

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**Note:** Immediate power surge alarm will show on the HMI screen after power up. This will reset itself after five minutes. Address any other alarms present (float switches, free product barrel level, pressure alarms, etc.).

5. Once alarms are addressed go to main menu and clear alarms.
6. Walk through system to check for leaks and ensure influent pump and discharge lines are properly connected. Ensure all valves are properly positioned. Ensure there are no obstacles over any moving parts.
7. Ensure influent/sump pump and discharge lines are properly positioned and connected. If discharging, make sure a dissipater plate is in place at the discharge point to prevent surface erosion.
8. If no issues are observed turn the system **ON** at the HMI. Pumps should be manually set to **AUTO** mode.
9. Observe system operation to ensure the OWS is operating as designed. Check flow rates, pressures and confirm discharge.
10. Open valves at top of adsorption units and bag filter to purge air as described above.

### 5.4.3 System Shutdown

1. Turn system **OFF** on HMI.
2. Shutdown generator if system will be off for more than approximately 12 hours.
   **Important Note:** Turn **OFF** main disconnect in the OWS control room if personnel plan on conducting work on the OWS while the system and generator are off.

### 5.4.4 Routine System Checks

During normal operation the OWS system should be checked every four (4) hours at a minimum. As the amount of wastewater in the berm decreases or as specific concerns arise, the OWS system should be checked more regularly to ensure excessive amounts of sand or free product are NOT entering the system. The following instructions outline the tasks that should be completed during these routine checks.

1. Walk through system to check for leaks and ensure influent pump and discharge lines are properly placed/connected.
2. Confirm discharge flow and conduct visual inspection for any sheen or odor at the discharge location.
3. Record flow rates and pressures. Complete Daily Log presented in Appendix D. Collect samples as outlined in Section 5.5.2.
4. At the API, check level of free product using dipstick and water-detecting paste. If the free product level is 1/4" or more thick adjust the slotted pipe at the far end of the API using a 4" pipe wrench. The slit in the pipe should be at the surface of the liquid, just enough to remove any free product, and leave any remaining water in the tank. **Note: This is a completely manual step. Do not leave the slotted pipe at the liquid surface unattended for long periods of time as the free product**

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**level will change over time and result in the free product collection barrel quickly filling up with water.**

5. Check level of free product around sump in the berm. If there is significant free product present protect the intake pump with booms. If necessary, the OWS may need to be shut down temporarily to remove excessive amounts of free product within the sump area.
6. Adjust flow balance between influent pump (P 4001) and API discharge pump (P 4901) using the appropriate ball/globe valve if required.
   **Note:** The target flow rate from the API effluent pump (P 4901) is 30 gpm (20 gpm if using four lead treatment barrel trains in parallel). Flow balance should be such that the desired flow rate through the system is achieved, and the influent pump runs continuously if possible. If the influent pump flow rate is greater than the API effluent pump the LAHH 4901 switch will turn the influent pump off to prevent overflowing the API. This will result in frequent LAHH 4901 alarms on the HMI. A significant amount of flow rate monitoring and adjustment may be required during the initial startup/commissioning of the system to achieve the proper flow balance.
7. Monitor bag filter inlet pressure. Replace bag filters if the maximum bag filter inlet pressure, 35 psi, is reached. Bag filters may require frequent replacement. Refer to Section 5.4.7.
8. Replace GAC/clay media if inlet pressure to the first adsorption unit exceeds 35 psi or if breakthrough of contaminants is observed in the final effluent (visual sheen or high TOG results).
9. Purge any air collected in the system via the vents on the bag filter/adsorption units.
10. Perform/schedule any required maintenance as per the Newterra O&M manual.
11. Collect and analyze samples according to Section 5.5 and take appropriate action.
12. If at any point during the operation of the mobile OWS, the final effluent at the discharge point is discovered to have a sheen or hydrocarbon odour, the OWS must be shut off and all discharge to the natural environment must stop immediately. Contact Environmental Coordinator.
13. If at any point during the operation of the mobile OWS, the internal TOG analyses indicates the final effluent does not meet the required discharge criteria outlined in Section 5.2, the OWS must be shut off and all discharge to the natural environment must stop immediately. Contact Environmental Coordinator.

### 5.4.5 System Alarms

The OWS system has several shutdown alarms and non-critical alarms. Shutdown alarms will turn the system off. Non-critical alarms will be displayed in the HMI and will activate the alarm light but will not shutdown the system. If an alarm appears on the HMI, investigate the cause and take the appropriate action. Once the issue has been addressed, clear the alarm using the HMI.

Refer to Section 3 in the Newterra O&M manual for details on the how the alarms are activated/deactivated.

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### 5.4.6 MAINTENANCE

Several maintenance activities will need to be carried out after a recommended number of operating hours have passed. Refer to Section 8 in the Newterra O&M manual for details on the maintenance procedures and required, daily, weekly, monthly and yearly checks.

- Strainer cleaning: every 200 operating hours
- Pumps: every 800 operating hours
- Pressure gauges: every 4000 operating hours

In addition to these activities the filter bags and media will need to be replaced based on system pressures and water quality. See the following sections for more information.

### 5.4.7 FILTER BAG REPLACEMENT

Filter bags will need to be replaced when the inlet pressure to the filter housings reaches 35 psi. At 40 psi an alarm will be initiated.

To change out the filter bags complete the following steps:

1. Turn the system **OFF**.
2. Close inlet and outlet valves.
3. Relieve the pressure in the bag filter housing via the valve at the top of the housing.
4. Undo the housing bolts and remove lid.
5. If possible remove some of the water from the filter housing by partially draining the housing through the two inch line at the bottom of the stand or by removing the water from the top. Ensure drained water is contained and not spilled on floor. The bag filters can be replaced without removing the water however replacing the filter bags is easier when the housings is not full of water.
6. Place used filter bags into a pail or other container for disposal. The bags will be water logged and heavy. Use two people if required and proper lifting techniques (lift with knees NOT back). Filters can be burned and should be dropped off at the Waste Management Building to be incinerated onsite.
7. Insert new filter bags into the housing. The bags should fit flush at the top. Change all seven bags at the same time.
8. Apply silicon grease to the O-ring to prevent leaks from the lid if required.
9. Close the lid and bolt the lid down.
10. Check strainers and empty if required.
11. Open valves to bag filters.
12. Perform pre-start checks of system and turn system **ON**. Remove air trapped in filter housing by opening valve at top of housing until water is observed.

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### 5.4.8 Lead Removal Media

As discussed in Section 5.3, eight barrels containing lead removal media (Metsorb HMRG) should be added downstream of the system following the adsorption tanks if lead concentrations in the effluent exceed discharge criteria. The maximum flow through one barrel is 5 gpm, therefore the maximum flow through four barrels in parallel is 20 gpm. At an influent concentration of 5 µg/L (effluent of >1 µg/L) 1 $ft^3$ of media should be able to process approximately 70 $m^3$ of wastewater. Other heavy metals and contaminants in the wastewater will also be adsorbed by the media so the volume of water processed by each cubic foot of media will vary and depend on the total amount of metals in the wastewater. Taking samples of the final effluent and the discharge from the first row of barrels will indicate when the media needs to be replaced.

#### 5.4.8.1 Lead Media Replacement Procedure

If breakthrough (exceedance) is observed at the discharge of the first row of four barrels, the media in these barrels should be replaced and the order of the barrels switched. **The four barrels with new media will be moved to the second row and barrels that were originally in the second row with be moved to the first row.**

To change out the lead media in the barrels complete the following steps:

1. Drain barrels.
2. Remove lids and scoop out spent media into labelled Quatrex bags for hazardous waste disposal.
3. Rinse barrels with a small amount of clean water.
4. Replace or rinse filter sock on bottom piping inside the barrels.
5. Put on appropriate respirators and review MSDS for procedures on handling media. Slowly pour new media into barrels being careful not to damage piping at bottom of barrels. Barrels will be approximately 1/3 full of media with 3-3.5 $ft^3$ of media. Settling of media inside the barrel can be aided by tapping the barrel sides with a rubber mallet.
6. Replace lids and ensure adequate seal.

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## 5.5 Sampling Schedule, Supplies and Procedures

The following table provides the sampling schedule and requirements for the commissioning and normal operation of the OWS. Confirm with Environmental Coordinator when sending out external samples.

Table 5-5 – **Sampling Schedule**

| Parameter | Location within OWS | Internal Sampling Frequency | External Sampling Frequency |
|---|---|---|---|
| Oil and Grease | Influent | Start of open water season at each source/facility that contains wastewater potentially requiring treatment | Start of open water season at each source/facility that contains wastewater potentially requiring treatment |
| | API Effluent | Every 4 hours | |
| | Final Effluent | Every 4 hours | Prior to discharge/ Weekly during discharge |
| Total Lead<br>pH<br>TSS (only effluent) | Influent | | Start of open water season at each source/facility that contains wastewater potentially requiring treatment |
| | Final Effluent | | Prior to discharge/ Weekly during discharge |
| Benzene<br>Toluene<br>Ethylbenzene | Influent | | Start of open water season at each source/facility that contains wastewater potentially requiring treatment. |
| | GAC #1 Effluent | | Weekly |
| | Final Effluent | | Prior to discharge/ Weekly during discharge |

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### 5.5.1 SAMPLING EQUIPMENT

- Required PPE (refer to Section 2.2.2)
- Sampling bottles: Group 5 bottle set for external samples (See Appendix E for exact bottle set requirements), 250 mL glass wide-mouth jars for internal samples.

### 5.5.2 SAMPLING PROCEDURE

1. Obtain and wear appropriate PPE listed in Section 2.2.2.
2. Obtain sampling equipment outlined Section 5.5.1.
3. Check HMI to identify any active alarms.
4. Conduct a visual inspection to identify any leaks, system failures, and potential hazards (high pressures, electrical malfunctions, improperly opened valves, poor discharge/recirculation lines, etc.),
5. Record any system failures, leaks, hazards or inconsistencies observed on the Daily Log (refer to Appendix D).
6. Record all readings on the Daily Log.
7. Collect water samples at designated sampling ports for analyses (see Table 5-5 for required sampling locations and analysis).
8. Use 250mL wide-mouthed glass jars to collecting internal samples. Samples should be labeled with the date, time and sampling location/station. Internal sampling jars can be reused for internal analyses however, if reused, sampling jars should be used for the same sampling locations within the system (i.e. influent, effluent, etc.). Replace jars if suspected cross contamination is occurring.
9. All internal samples should be collected by following steps 1 through 6 at the required intervals outlined by Table 5-5.
10. Analyze internal samples for TOG following the analysis procedure outlined in Section 5.5.3.
11. Complete Daily Log with all the required information filled out including the date, time of routine checks, pressure readings throughout the system, totalizer values and internal TOG results. At the end of the day, information on the Daily Log will be transferred to the electronic Discharge Log located on the Mine Site Environmental Server (refer to Appendix D).
12. External samples must be collected according the Sampling Schedule (Table 5-5) and should be delivered to the onsite ALS lab within 24 hours of being collected accompanied with a completed COC.

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### 5.5.3 TOG Sample Analysis Procedure

Required Lab Supplies, Equipment and PPE

- 2 x 20ml glass graduated cylinder
- Glass funnel
- TOG analyzer + cuvette(s)
- Sulphuric Acid (98%) + pump
- S-316 Solvent
- Sodium Sulfate, anhydrous
- Spoon
- Pipette and tips
- Two glass mix jars for influent and effluent samples with 100ml marked
- Whatman filter Paper
- Kim wipes
- Nitrile gloves
- Lab coat
- Safety glasses

1. Turn TOG analyzer **ON** if it is not already on. Allow TOG analyzer to warm up for 1 hour.
   **Note:** The TOG analyzer can be kept on for the entire length of time the mobile OWS is operating.
2. Rinse all glassware with solvent: Horiba S-316 (i.e. funnels, graduated cylinders, pre marked 100mL mix jars, and cuvettes)
3. Add 100mL of sample to pre-marked mix jar.
4. Add 1mL of sulfuric acid (~98% conc.) to sample in mix jar.
5. Shake for 10 seconds.
6. Add 11mL of solvent to sample. The volume of solvent should be 10% of the total volume of solvent-sample mix.
7. Shake the mix jar for 2 minutes, opening mix jar at least twice to release any vapour buildup.
8. Allow mix jar contents to settle. A solvent layer containing the hydrocarbons in the sample should form at the bottom of the mix jar.
9. Fill cuvette with solvent, wipe thoroughly with Kim wipe and place in analyzer. This will serve as a blank.
10. Press and hold ZERO on analyzer. BAL will display on the screen followed by a number. Leave the cuvette in the analyzer and press RUN. If the result is within ± 2 mg/L the analyzer is zeroed.
    **Note:** The cuvette should be placed in the analyzer with the frosted side facing you. The cuvette should always be placed in the analyzer in the same direction.
11. Add 1 spoonful of sodium sulfate to a folded Whatman filter in the glass funnel.
12. Extract settled solvent layer from bottom of mix jar with a 10mL pipette and filter it through the sodium sulfate inside the Whatman filter and into a clean graduated cylinder. This will remove any remaining water captured during the extraction of the solvent. Only 3-5 mL of filtered solvent

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is required to analyze the solvent layer and determine the hydrocarbon concentration in the sample (i.e. effluent, influent, etc.).

13. Fill cuvette with the filtered solvent, wipe thoroughly with Kim wipe and place in analyzer.
14. Press **RUN** to analyze.
15. Record results on Daily Log.
16. If TOG results seem high in comparison to external results, clean all glassware with solvent and redo analysis. If the hydrocarbon concentration in the influent sample water is equal or greater than 120 mg/L, system checks should be done more frequently and sampling should increase to every two (2) hours. Notify Environmental Coordinator of inflated TOG levels in influent.
17. If at any point during the operation of the mobile OWS, the internal TOG analyses indicates the final effluent does not meet the required discharge criteria outlined in Section 5.2, the OWS must be shut off and all discharge to the natural environment must stop immediately. Contact Environmental Coordinator.

## 5.6 Decommissioning the Oil Water Separator

The following procedures should be followed to safely and effectively decommission the mobile OWS unit when transporting the unit between Project sites or for winterization/end of season storage.

### 5.6.1 Decommissioning For Transport

Before transporting the mobile OWS unit between Project sites, the unit must be drained. The draining procedure required for transport is identical to seasonal storage draining procedure (refer to Section 5.6.2), however since this is completed to reduce weight for shipping, the lines and pumps are not required to be drained since this is a very time consuming process. Only media vessels and the API tank are required to be drained prior to transport. Additionally, all valves should remain closed during transport.

### 5.6.2 Decommissioning For Seasonal Storage

The decommissioning of the mobile OWS unit for seasonal storage requires all water to be drained from the system. Electricians are required to disconnect all wiring. All drained sensors and pumps should be placed and stored inside the control room. All hoses and lines must be drained of any residual water so that lines can be disassembled and will not rupture due to ice expansion. Hoses and lines should be drained using the valves at low points and available ports. Residual water must be drained back into the berm or captured in pails/tubs to be eventually transferred back into berm. Spilling contaminated water onto the ground is considered a spill and must be reported.

Complete removal of all water is required for the adsorption tanks and API tank.

To drain the three (3) adsorption tanks, a 3" trash pump must be hooked up to the bottom ball valve of each adsorption tank and used to effectively pump out all remaining water out of each tank. To minimize the possibility of removing any media in this process, the bottom ball valve on the bottom of each adsorption tank should only be partially opened and the trash pump should be throttled down to its lowest

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setting to reduce the overall flow rate/vacuum at the outlet of each adsorption tank. When each tank is empty and the trash pump begins to suck in air, the trash pump must be shut-down for 5-10 minutes to allow residual water to gravity drain through media and collect at the bottom of the adsorption tank.

Leave the bottom ball valve of each adsorption tank in the open position with a pail placed underneath the valve to catch any residual water dripping out of the tanks (empty as necessary). Open the lid on the top of each media vessel and allow the media to dry for a 2-3 days. If weather is cold, turn heaters on in the OWS unit or use a frost fighter to expedite the drying process.

To drain the API tank, setup a tub underneath the drain port on the outside of the OWS unit. Open the lowest ball valve on the drain port to allow the water in the API tank to gravity drain into the tub. Transfer contaminated water from the tub to the facility's containment berm.

Double-check that all valves and drain ports are opened and drained to ensure ALL residual water has been removed. It is absolutely critical that all lines, pipes, tanks and vessels have been completely drained of any water prior to freeze up.

## 5.7 OWS Discharge Log, Results Dissemination and Approval for Discharge

All the monitoring documentation to be completed during the operation of the OWS unit is located in the OWS Discharge Log file on the Mine Site Environmental Server at FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators. This file contains the Summary Sheet, the External Results Sheet and the Daily Log Forms presented in Appendix G, Appendix F and Appendix D, respectively.

The External Results Sheet presented in Appendix F must be updated upon receipt of any external sample results, including preliminary results. The Environmental Coordinator or his/her designate will provide the results to the Environment Superintendent and/or Manager who will assess the results and determine whether the effluent quality is acceptable for discharge or will assign instructions for additional treatment.

The Daily Log (refer to Appendix D) must be updated to include all internal samples and weekly external samples (if applicable) throughout the treatment process. End-of-shift cumulative discharge values and additional notes must also be recorded on the Daily Log.

The Summary Sheet (refer to Appendix G) must be filled out after all wastewater has been treated for a specific facility (i.e. Bulk Fuel Storage Facility, Landfarm Facility, etc.).

All documentation must be added to the appropriate site server location (FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators). Upon the completion of wastewater treatment at a facility, the completed OWS Discharge Log must be provided to the Environmental Coordinator, Superintendent and Manager.

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# 6 REFERENCES

AMEC FW, (2014). Baffinland Iron Mines field notes OWS. July, 2014

Water Licence No: 2AM-MRY1325 – Amendment No. 1, Nunavut Water Board (July 21, 2015)

Newterra, (2013), Process Treatment System Project # 102140. Operation and Maintenance Manual

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# APPENDIX A -

# NEWTERRA OWS O&M MANUAL

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1.0 Start Up Procedure
Commissioning Checklist
Test Records
Packing List

2.0 Mechanical Drawings

3.0 Electrical Drawings

4.0 Control Panel Module

5.0 Components

6.0 Specs

7 0 Manuals

8.0 System Maintenance, Troubleshooting

# RTS - 151
# 150 GPM WATER TREATMENT SYSTEM
# STARTUP PROCEDURE

- If the system is being started for the first time then work your way through the commissioning checklist in the installation guide or system manual before starting the system.
- If kill switch on panel (red mushroom shaped button) is pulled out then push it in to confirm that system is off.
- Pull kill button out in process room so the system can start at the appropriate time.
- Walk through process piping and check the position of all process valves.
- Check that there are no obstructions over any moving parts.
- Check that main disconnect is on.
- Put all hand/off/auto switches in auto.
- Pull the kill Button (red button on panel) out to start the process.
- Push the reset button on the operator interface to reset all alarms.
- Push the start button on the Operator Interface.
- If an alarm occurred on startup, then review the alarm descriptions and troubleshooting guide in the installation guide or manual for guidance on how to troubleshoot the problem. Fix the alarm condition and restart the system with the above procedure.

# RTS - 151 150 GPM

| | | | | |
|---|---|---|---|---|
| Mech Eng: | | Control: | Tester #1: | Warren, Kevin |
| Mechanical Team: | Electrical Team: | Panel Team: | Tester #2: | |
| -Select One- | -Select One- | -Select One- | | |
| | | | Start Date: | 8/20/2013 |
| | | | End Date: | 8/27/2013 |

## SECTION A - PRE-TEST FLOW RATES AND POWER DETAILS

| | | | |
|---|---|---|---|
| P-VLS | | B-STRIP | |
| B-SVE | | P-STRIP | |
| P-OWS | | C-SPRG | |
| OTHER: | | OTHER: | |

| System Certifications | Panel Standard | System Standard | SETPOINTS |
|---|---|---|---|
| Building #1 / Room #1: | UL 698A | MET us, Classified | |
| Building #2 / Room #2: | N/A | N/A | |
| **Site Power Requirements** | | | |
| Voltage: | 208 Vac | 3-Phase , 3-Wire | |
| Amperage: | 125 Amps | | |

**Notes:**

| SECTION B - WALK AROUND | OK / NA | INITIALS |
|---|---|---|
| Check That Walk Through Issues Have Been Resolved, Review Shop Aids | OK | KW |
| Lay Down Electrical Safety Mat and Set Up Testing Cart | OK | KW |
| Ensure That Testing Tote Is Connected and That Hoses Are Secure | OK | KW |
| Ensure That Carbon Vessels Are Bypassed | OK | KW |
| Verify That Exhaust Mufflers and Elbows are Installed (SVE/Sparge/Compressed Air) | OK | KW |
| Make Sure That Building Fan and Louvre Shipping Braces Have Been Removed | OK | KW |

| SECTION C - WALK THROUGH | OK / NA | INITIALS |
|---|---|---|
| Inspect Valves and Process Lines | OK | KW |
| Check Transmitter / Magnehelic Lines for Low Lying Spots Where Moisture can Collect | N/A | KW |
| Check That Floor Vents Have Been Installed | N/A | KW |
| Record Process Equipment Model and Serial Numbers* and Motor Nameplates | OK | KW |
| Notify Project Manager and Production Staff of Any Outstanding Issues | OK | KW |

* This includes motors, blowers, compressors, oxygen/ozone generators, pumps, etc.

| SECTION D - PANEL OFF INSPECTION | OK / NA | INITIALS |
|---|---|---|
| Check for Dielectric Test Label | OK | KW |
| Check for Auto Re-Start Label, Check for Ground, L1, L2, L3 and High Leg Labels | OK | KW |
| Check for IS Wiring Warning Stickers in Panel and on Lines From Panel | OK | KW |
| Ensure Neutral Wire is Connected To Terminal Block | OK | KW |
| Inspect 24Vdc and 120Vac Relays for Proper Connections | OK | KW |
| Check That Spare IS Input Wires Are Pulled | OK | KW |
| Cross Check Fuses, Circuit Breakers and Starters with Fuse Schedule | OK | KW |
| Determine Service Factor Amps and Set Motor Overloads | OK | KW |

| SECTION E - PANEL ON INSPECTION | OK / NA | INITIALS |
|---|---|---|
| Record Test Supply Voltages | | |
| Primary: L1/L2 213, L2/L3 213, L3/L1 213 Vac; L1/N 124, L2/N 124, L3/N 124 Vac — Secondary: L1/L2 245, L2/L3 124, L3/L1 Vac; L3/N Vac | | |
| Record 24Vdc Supply Voltage 24 Vdc | OK | KW |
| Test GFI and non GFI Outlets | OK | KW |
| Check "Push To Test" Panel Indicators | OK | KW |
| | N/A | KW |

| SECTION F - INITIAL SYSTEM SETUP AND TESTING | OK / NA | INITIALS |
|---|---|---|
| Archive Pre-Test Program Revisions and Create New Revision | N/A | KW |
| Check E-mail Configuration Through ECOM Card on PLC | N/A | KW |
| Record H0-ECOM100 Firmware Revision v. | N/A | KW |
| Update PLC Firmware and Record Revision: v. | OK | KW |
| Initialize Scratch Pad of Automation Direct PLCs | OK | KW |
| Upload PLC Program | OK | KW |
| Set PLC Clock and Calendar | OK | KW |
| Check Functionality of All Discrete Inputs | OK | KW |
| Check Functionality of All Discrete Outputs | OK | KW |
| Check Functionality of All Analog Inputs and Outputs | OK | KW |
| Switch System Outputs to AUTO Mode | OK | KW |
| Set and Test All Setpoints | OK | KW |

| SECTION G - OPERATOR INTERFACE (PANEL DOOR / TOUCHSCREEN) | OK / NA | INITIALS |
|---|---|---|
| Type of Operator Interface: -Select One- | | |
| Update Display Screen Firmware, Record Revision v. | OK | KW |
| Upload Panel Program | OK | KW |
| Test Panel Menu Hierarchy | OK | KW |
| Check PLC to Panel Communication, Remove Ground Jumper if Necessary | OK | KW |
| Verify Value, Scale, Significant Digits and Units of Analogue Signals | N/A | KW |
| Check Functionality of All Discrete Inputs | OK | KW |
| Check Functionality of All Discrete Outputs | OK | KW |
| Test All User-Adjustable Setpoints | OK | KW |
| Verify Correct Hourmeter Values, Ensure Proper Time is Kept | OK | KW |

| SECTION H - VFD / SOFT START DEVICES | OK / NA | INITIALS |
|---|---|---|
| Drive Type and Application: N/A N/A | | |
| Verify Drive Parameter Settings Match Electrical Drawings | N/A | KW |
| Test Frequency Control | N/A | KW |
| Check VFD Noise on Analog Signals / Adjust Carrier Frequency Accordingly | N/A | KW |
| Save VFD Set-up Variables From PowerSuite / Record VFD Settings | N/A | KW |
| Verify Integrity of RS-485 Communications, Record Settings | N/A | KW |
| BAUD: N/A PARITY: N/A STOP BITS: N/A CARRIER: N/A | | |

| SECTION I - ANALOG SIGNALS | INITIALS |
|---|---|
| PLC Card Slot #1: N/A - Not Installed | KW |
| PLC Card Slot #2: N/A - Not Installed | KW |
| PLC Card Slot #3: N/A - Not Installed | KW |
| PLC Card Slot #4: N/A - Not Installed | KW |

| | | |
|---|---|---|
| Check mA Signals at Different Operating Points for Device Hysterisis and Calibration | N/A | KW |
| Check Conversion Math and Square Root Functions in PLC Logic | N/A | KW |

| SECTION J - SYSTEM OPERATION | OK / NA | INITIALS |
|---|---|---|
| Check Building Fan(s) and/or Heater(s) Operation | OK | KW |
| Test All Kill Buttons | OK | KW |
| Bump Motors and Check For Excessive or Abnormal Current Draw | OK | KW |
| Ensure that LSL Switches are Above Pump Intakes | OK | KW |
| Set and Test Pressure and Vacuum Relief Valves According to P&ID | N/A | KW |
| Thoroughly Test Control Logic | OK | KW |
| Check Functionality of Oxidizer Interlocks | N/A | KW |
| Run System In Full Automatic | OK | KW |
| Simulate All Alarms, Check That Non-Critical Alarms Do Not Shut Down System | N/A | KW |
| Check Magnehelic Gauges for Accuracy, Verify Air Flows Using Hot Wire Anemometer | N/A | KW |
| Measured CFM: @ PSI/"Hg/"WC | | |
| Measured CFM: @ PSI/"Hg/"WC | | |
| Measured CFM: @ PSI/"Hg/"WC | | |
| Measured CFM: @ PSI/"Hg/"WC | | |
| Verify Logic and Flow For All Solenoid Valves, Including Auto-Oilers | N/A | KW |
| Run System With Doors Closed and Monitor Ventilation | N/A | KW |
| Verify Auto Restart Functionality of Whole System (Including VFD) | OK | KW |
| Check for Water / Compressed Air (Bubble Test) Leaks | OK | KW |

| SECTION K - PLC FINAL CHECK | OK / NA | INITIALS |
|---|---|---|
| Check Hour Meter Variable Memory Locations and Minute Counters | N/A | KW |
| Force Datalogging | N/A | KW |
| Update PLC Program Revision(and Operator Interface if Applicable) | OK | KW |
| Final Program Revision # : v. 2.0 | | |

| SECTION L - TELEMETRY | √OK/ NA | INITIALS |
|---|---|---|
| Select Communication Type: | | |
| Confirm Remote Access, Record Method | N/A | KW |
| Check Modem Auto-Reboot Feature | N/A | KW |
| Test System Operation Using Offsite Package, Review Datalog Files | N/A | KW |
| Test System Email Out | N/A | KW |
| Configure Autodialer (Set Sensaphone Passwords to "2000" and "s2000") | N/A | KW |
| Test Autodialer Alarm Dial-out and Report | N/A | KW |

| SECTION M - FINAL SYSTEM TESTING / AS BUILT | OK/ NA | INITIALS |
|---|---|---|
| Record Max Noise Level dBA @ ft. | N/A | KW |
| Record Motor Voltages, Currents and Operating Conditions | OK | KW |
| Add Flow Charts, Piping Labels (Hot**, Directional), Oxygen / Ozone Generator Labels | OK | KW |
| Pump Water Out Of System | OK | KW |
| Turn Off All Breakers and HOA Switches | OK | KW |
| Take System Pictures | OK | KW |
| Email Project Manager and Production Staff | OK | KW |
| Update System Approval Data Plates, Fuse Schedule and Startup Procedure | OK | KW |
| Ensure appropriate approval labels are obtained (GP, Haz). **Rentals require US and CAN.** | OK | KW |
| Attach System Approval Stickers, Fuse Schedule and Startup Procedure | OK | KW |
| Take Panel Pictures and Transfer All Pictures to Project Folder | OK | KW |
| Check Off "Testing" as Being Complete in APES | N/A | KW |
| Make Changes to the IO and Alarms Tables Are Captured in the Markups | OK | KW |
| Update Project Software Folder | OK | KW |

Copy Completed Test Sheets to Electrical As-Builts Directory with DWG Files and Bill of Materials
Check Off "As-Builts" Box in APES
** Hot Labels to be Applied to Any Piping >/= 140 DegF as Determined by IR Readings

## MECHANICAL TEST RECORD

| | | | |
|---|---|---|---|
| Device Name: | **P-4901** | Manufacturer: | **GOULDS** |
| Device Model #: | **4SH2K52COW** | Device Serial #: | **F1200054** |
| Motor Manufacturer: | **WEG** | Area Classification Tag Checked: | |
| Motor Model #: | **JM007402** | Motor Serial #: | **1014500858** |
| HP: | **7.50** | Voltage: **208** | Frame: **184JM** RPM: **3480** |
| Phase: | **3** | Current: **20.70** | SF: **1.15** ENCL.: **TEFC** |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| **20.9** | **20.6** | **21.4** | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| **213** | **213** | **213** | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | **P-4001** | Manufacturer: | **GOULDS** |
| Device Model #: | **WS15112BHF** | Device Serial #: | **RC-061** |
| Motor Manufacturer: | **GOULDS** | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | **1.50** | Voltage: **230** | Frame: RPM: **3450** |
| Phase: | | Current: **18.00** | SF: ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| **17.1** | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| **213** | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | | Voltage: | Frame: RPM: |
| Phase: | | Current: | SF: ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | | Voltage: | Frame: RPM: |
| Phase: | | Current: | SF: ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

**MECHANICAL TEST RECORD**

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

**MECHANICAL TEST RECORD**

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |

| | |
|---|---|
| Vac | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

| | | | |
|---|---|---|---|
| Device Name: | | Manufacturer: | |
| Device Model #: | | Device Serial #: | |
| Motor Manufacturer: | | Area Classification Tag Checked: | |
| Motor Model #: | | Motor Serial #: | |
| HP: | Voltage: | Frame: | RPM: |
| Phase: | Current: | SF: | ENCL.: |

| Factory Test: | | | | Field Test: | | | |
|---|---|---|---|---|---|---|---|
| L1 | L2 | L3 | | L1 | L2 | L3 | |
| | | | Amps | | | | Amps |
| L1/L2 | L2/L3 | L3/L1 | | L1/L2 | L2/L3 | L3/L1 | |
| | | | Vac | | | | Vac |

# Pre-commissioning Checklist

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**Please return copy of completed form to newterra prior to startup Project number and name:**

The purpose of this report is that the customer is prepared for startup.

Please send us the completed Pre-Commissioning Checklist 5 days prior to our site visit.

Return to Shane Henderson at shenderson@newterra.com or Fax 613-345-7633

Checked by: Date:

| Checklist | Ck |
|---|---|
| Verify site power is correctly installed to the control panel and necessary electrical approvals have been completed. | |
| Verify that all input wiring is completed and wired into the control panel according to the installation guide. | |
| Verify that all power wiring is completed and wired into the control panel according to the installation guide. | |
| Verify that Compressed air will be connected to system (if required). | |
| Verify that Fresh Water supply is installed to system (if required). | |
| Verify that all process piping will be installed and completed. | |
| Verify that the required approvals are in place to allow the system to discharge air and water as designed. | |
| Verify that system has been installed on a level pad. | |
| Verify that all field piping will be completed and wells will be connected to the operating system. | |
| Verify that phone line is installed and activated if required. | |
| | |
| | |
| Additional Checklist Items related to Oxidizers | |
| Verify that all necessary wiring is completed between the oxidizer and the main control system. | |
| Verify that all piping between oxidizer and treatment system is completed. | |
| Verify that Power is connected to oxidizer and necessary electrical approvals have been completed. | |
| Verify that the required approvals are in place to allow the oxidizer to discharge air to the atmosphere. | |
| Verify that Gas is connected to the oxidizer and activated to allow for testing of the oxidizer.<br>Note: Please ensure that the gas supply valves are not locked out by the local gas installer at time of commissioning. | |
| If local gas approval is required for oxidizer, ensure that this is completed or planned to occur during the commissioning. | |

******All Tasks will be completed No Later Than 5 Business days prior to newterra Technicians arrival onsite.***

Please note if newterra arrives onsite and items have not been completed there will be a charge associated.

Site Address: _____

_____

_____

Onsite Contact Name & Number: _____

_____

Customer Sign-off Date

# System Field Test Checklist

This purpose of this report is to test the functionality of electrical, control, and mechanical components to ensure the system operates as originally designed. This testing is then documented so it can be referenced at a later date if needed.

The following field test records must be completed by the startup technician on site before operating the process system. This is the last quality check ensuring the process equipment is ready for continuous operation.

newterra™ highly recommends that the system is started by a newterra factory trained startup technician to ensure the long term success of your project. We understand that this may not always be feasible in which case we would require a highly skilled technician capable of troubleshooting both mechanical and electrical aspects of a process treatment system and be familiar with our manual, equipment and capable of training the operator on operating and maintenance requirements of the treatment system.

This checklist must be sent back to Product Support department at newterra to validate your equipment warranty which begins on the date of shipment from the factory. It can be sent back in one of the following methods:

Email: service@newterra.com

Fax: Att: Product Support
(613) 345 7633
If you choose to fax the document then, please follow up with an email explaining that a fax was sent so we can ensure that we received the fax and properly validated the equipment warranty.

Project number: _____
Project name: _____

Tested By: _____
Company: _____
Date Tested: _____

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# System Field Test Checklist

Minimum Tools Required:

| | |
|---|---|
| Clamp style amp meter | Socket Set |
| Multi meter for AC/DC Volts and ma signals | Wire Cutters |
| Instrumentation Screw Driver | Wire Strippers |
| Screw Driver Set | Channel Locks |
| Wrench Set | Pipe Wrenches |
| Straight Edge for Aligning couplings and belts | |

| Testing Checklist | Ck | Initial | Date |
|---|---|---|---|
| Verify site power per system design criteria | | | |
| Verify building process flow and instrumentation matches P +ID drawing, check off drawing components against actual (preferably with the customer present) | | | |
| Ensure all unions are tight, as some are loosened to prevent stress in shipping. | | | |
| Walk through system and open all valves that are required to run the system in automatic | | | |
| Check panel for lose wiring | | | |
| Tighten all terminals where wires are terminated | | | |
| Check alignment of motors | | | |
| Check field wiring and piping as per drawings | | | |
| Check all motor belt tensions | | | |
| Turn power on. Measure site voltage. L1/L2_____ L2/L3_____ L3/L1_____ L1/GRD_____ L2/GRD_____ L3/GRD_____ | | | |
| Test that incoming power has correct phase sequence. Bump a safe 3 phase motor to test rotation. | | | |
| Check voltage on AC step down transformer | | | |
| Check voltage on DC transformer | | | |
| Check rotation of all motors that were field wired. | | | |
| Check that PLC Run light is on and the stop/term/run switch is in term | | | |
| Manually test inputs as per input table | | | |



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# System Field Test Checklist

| | | | |
|---|---|---|---|
| Check connections of all field wiring to ensure it was completed per the electrical drawings and per the NEC. | | | |
| Manually test control logic for each output | | | |
| Manually test all shut down alarms | | | |
| Manually test that non-critical alarms do not shut down SVE | | | |
| Run through complete logic and alarm sequence with customer and make allowable changes. | | | |
| Note name of individual and company with whom logic was reviewed: | | | |
| Check overload settings for all motors | | | |
| Check/Install filter bag in bag filters | | | |
| Test analogue inputs | | | |
| Run system in full automatic | | | |
| Fill out mechanical test record on each motor and check amperage and voltage. Document amperage on the System test records in the operating manual in the Field test load section. | | | |
| Wet test all control inputs and outputs | | | |
| Wet test all shut down alarms | | | |
| Check systems for leaks (liquid and vapor) | | | |
| Test position of ball float switches for proper start/stop level | | | |
| Test vacuum and pressure relief valve | | | |
| Test air stripper and discharge pump operating sequence | | | |
| Check flow rate on all pulse meters such that digital and analogue reading increment at the same rate | | | |
| Test operation of building exhaust fan | | | |
| Test operation of building heater | | | |
| Install louver hoods on system | | | |
| Test remote access | | | |

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# System Field Test Checklist

| | | | |
|---|---|---|---|
| Test operation of Auto dialer and program if necessary. | | | |
| Note newterra modem offsite web address | | | |
| Check flow rate discharging from VLS, should maximize flow to prevent a high level shutdown. If you have a centrifugal pump ensure flow rate is low enough to prevent cavitation on the inlet under vacuum. | | | |
| Check the skimmer on the oil water separator should be ½" above water level when water is flowing at full speed. Adjust if necessary. | | | |
| If Kaeser Compressor Present – Confirm warranty validation has been completed and submitted to Kaeser for warranty | | | |
| Check water flow rate into stripper, should be set to minimum flow to keep up with incoming water to maximize contact time in the air stripper. Adjust flow rate if necessary. | | | |
| Check flow rate exiting the air stripper, if there is no carbon filters down stream then allow pump to discharge at maximum flow rate. If carbon vessels are installed, then set pump flow rate to the designed system flow rate | | | |

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# System Field Test Checklist

| Customer Training Checklist | | | |
|---|---|---|---|
| Review the operating manual with the customer explaining the various components of the manual and sources of information. | | | |
| Review the startup and shutdown procedure with operator. | | | |
| Review operation of treatment system and describe the maintenance required for each piece of equipment. | | | |
| Describe operation of panel and panel components. | | | |
| Train customer to troubleshoot alarms based on input conditions to the PLC or relays in the panel. | | | |
| Discuss the operating logic with the customer so they understand how the system is configured to work. | | | |



# System Field Test Checklist

## Operating Data and Records

The following table is a guideline to document the operating conditions of the system when running in automatic mode. The startup technician should document the operating conditions at all the locations in the system. This information can be used at a later date to troubleshoot problems that can arise.

| Location of Record Description | Recorded Value |
|---|---|
| Air Vacuum readings: | |
| | |
| | |
| | |
| | |
| Air Pressure Readings | |
| | |
| | |
| | |
| | |
| Water Pressure Readings | |
| | |
| | |
| | |
| | |
| Water Flow Rates | |
| | |
| | |
| | |
| Air Flow Rates | |
| | |
| | |
| | |
| | |
| Operating Temperatures: | |
| | |

# System Field Test Checklist

**Site Contractor Information:** It is important that we capture the site contractor's information who was involved in the mechanical and electrical installation of equipment on site. We may be required to contact these companies during the project life to provide services at a later date.

## Electrical Contractor:

Company Name: _____

Contact: _____

Phone Number: _____

## Mechanical Contractor:

Company Name:

Contact: _____

Phone Number:

**Quality Issues Identified during startup:** The intension in this section is to list any problems, deficiencies or quality issues that were identified during startup. If the problem was solved during startup, please indicate. If MLE is required to follow up then please indicate.

Issue 1: Identified:

_____

_____

_____

Check box that applies: newterra Follow up Required ☐ Sorted out on Startup ☐

Issue 2: Identified:

_____

_____

_____

Check box that applies: newterra Follow up Required ☐ Sorted out on Startup ☐

Issue 3: Identified:

_____

_____

_____

Check box that applies: newterra Follow up Required ☐ Sorted out on Startup ☐

# System Field Test Checklist

**Customer Feedback:** newterra is committed to the success of our customers'. Please take a moment and provide any suggestions you may have for our quality and product support teams. We appreciate your comments and look forward to working with you again in the near future.

Please list one item you like about the system you have received:

Please indicate if there are items we could improve upon:

# System Field Test Checklist

| MECHANICAL TEST RECORD | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

# System Field Test Checklist

| MECHANICAL TEST RECORD | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device Name: | | | | Manufacturer: | | | |
| Device Model #: | | | | Device Serial #: | | | |
| Motor Manufacturer: | | | | | | | |
| Motor Model #: | | | | Motor Serial #: | | | |
| HP: | | Voltage: | Frame: | | | RPM: | |
| Phase: | | Current: | SF: | | | ENCL.: | |
| Factory Test: | | | | Field Test: | | | |
| L1 | L2 | L3 | Amps | L1 | L2 | L3 | Amps |
| L1/L2 | L2/L3 | L3/L1 | Vac | L1/L2 | L2/L3 | L3/L1 | Vac |

# *Project Packing List*

PMProjNum **102140**

SOLD - USED RTS151 - Baffinland 150GPM W

***PM_ShippingNotes:***

| Tag | Part Number | Part Description | Req / Rec | PO # / Line | EngMemo |
|---|---|---|---|---|---|
| 2 | 18661 | Hose, Assembly, J300, 3" | 2 | - | |
| Inlet & Outl | ea | Green Hose | 0 | | |
| Type: G | | -3" x 50' Hose assembly with camlocks | | 0 | |
| 2 | 10541 | Camlock Fitting, Aluminum, 3", Part "F" | 4 | | Male Camlocks |
| Inlet & Outl | ea | Male Adapter x Male Thread Cam Lock Fitting | 4 | | |
| Type: F | | - | 102140-003 | 2 | |
| 2 | M1108 | Switch, Level, Mech Float, Wide Angle, N.O., | 1 | --- | |
| LSH-4001 | ea | Tilt Float Level Switch 90deg, w 40' cable | 1 | | |
| Type: I | | 13A, SPST, N/O<br>--- | 102140-011 | 9 | |
| 2 | 17149 | Manual, System, Hard Copy | 2 | --- | |
| Manual | ea | | 0 | | |
| Type: P | | --- | | 0 | |
| 2 | 9999 | Misc Part, See Details | 1 | --- | |
| OWS VEN | ea | As per detailed specification below | 0 | | |
| Type: P | | 2IN. X 4FT. PVC OWS VENT STACK | | 0 | |
| 2 | RC061 | Pump, Sump, Goulds, 100GPM @ 40' | 1 | --- | |
| P-4001 | month | WS1512BHF, w/ switch | 0 | | |
| Type: R | | 230V 1 Ph, 1-1/2 HP<br>--- | | 0 | |
| 2 | RTS151 | WTS, 150 gpm, OWS-24, Carbon, 40' Contair | 1 | --- | |
| System | month | 208/120V, 3ph, Cl1 Div 2 | 0 | | |
| Type: R | | Max Water 150gpm @ 40psi<br>--- | | 0 | |
| 5200 | M1272 | Camlock Fitting, Aluminum, 2", Part "F" | 1 | --- | |
| 5200-Stack | ea | Male Adapter x Male Thread Cam Lock Fitting | 0 | | |
| Type: F | | --- | | 0 | |
| 5200 | M1137 | Drum, Black, Steel, 45 gal, 2 hole lid, bottom ? | 1 | - | |
| PST-5201 | ea | including palletization | 1 | | |
| Type I | | - | 102140-011 | 4 | |
| 5200 | 9999 | Misc Part, See Details | 1 | --- | |
| PST-5201 | ea | As per detailed specification below | 0 | | |
| Type: P | | 2IN. X 5 FT. TANK TRUCK HOSE ASSEMBLY<br>WITH CAMLOCK, TYPE C AND TYPE F | | 0 | |
| 5200 | 9999 | Misc Part, See Details | 1 | --- | |
| PST-5201 | ea | As per detailed specification below | 0 | | |
| Type: P | | 2IN. X 4FT. PVC PST VENT STACK | | 0 | |

| Tag | Part Number | Part Description | Req | PO # | | EngMemo |
|---|---|---|---|---|---|---|
| | | | Rec | Line | | |
| 7900 | 10908 | Lock, Passage, 107188, Taymor | 2 | | --- | |
| 7900 | ea | 107188 | 0 | | | |
| | Type: I | --- | | | 0 | |
| 7900 | 10909 | Lock, Deadbolt, 289648, Taymor, 1 cyl, S/S | 2 | | --- | |
| 7900 | ea | keyed alike #289648 | 0 | | | |
| | Type: I | --- | | | 0 | |
| 7900 | 24662 | Hood, Fan, 27" - on use up | 2 | | --- | |
| F-7901 | ea | Fits 24" Fan | 2 | | | |
| | Type: I | --- | 102140-011 | | 6 | |
| 7900 | 23989 | Hood, 15" | 2 | | --- | |
| F-7902 | ea | Fits 12" Fan & Louver | 2 | | | |
| | Type: I | --- | 102140-011 | | 5 | |

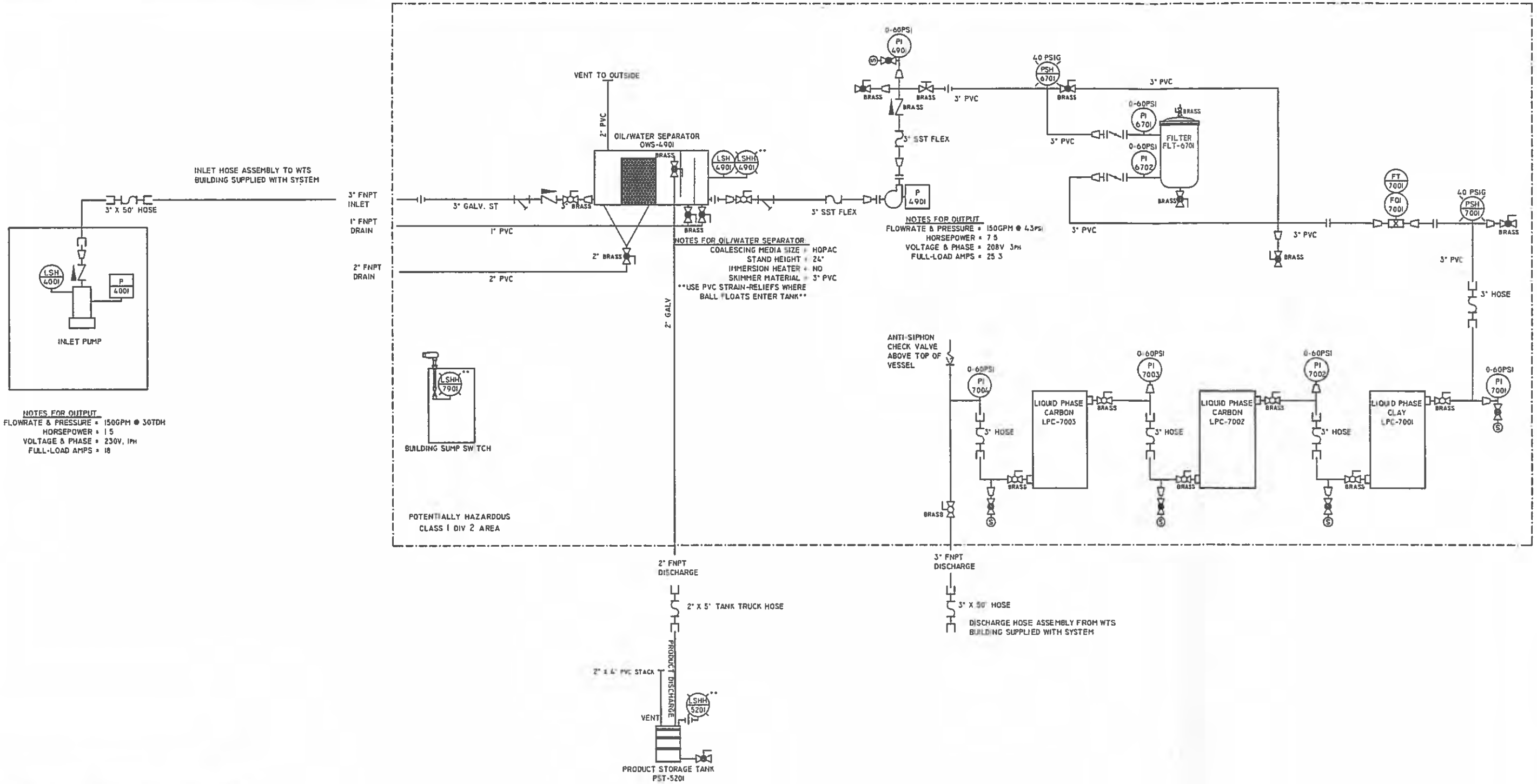
# *Project Packing List*

PMProjNum **102140A**

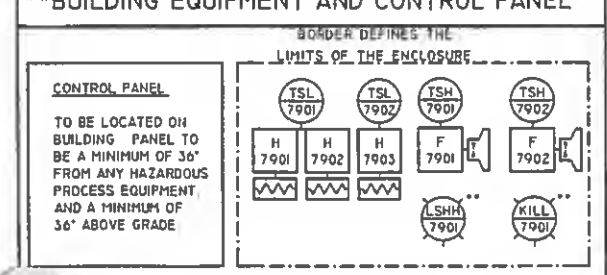
Baffinland 20' Container for Loose Components

***PM_ShippingNotes:***

| Tag | Part Number | Part Description | Req / Rec | PO # / Line | EngMemo |
|---|---|---|---|---|---|
| 1 | 11686 | Filter, Bag, FOS P2P, 7" x 32" | 120 | --- | |
| EXTRA | ea | Oil Absorbing Bags, Sub-micron, Plastic Ring | 0 | | |
| | Type: P | Box Quantity, 20 per box<br>--- | | 0 | |
| 1 | 25263-T | Melt-Blown Spaghetti Media | 15 | --- | |
| EXTRA | ea | Filter Bag Insert, Oil-Absorbing, Polypropylene | 0 | | |
| | Type: I | 25 lbs/bag<br>--- | | 0 | |
| 1 | 11214 | Media, Clay, TM100 | 5000 | --- | |
| EXTRA | lb | (stocked and ordered in lbs) | 0 | | |
| | Type: I | --- | | 0 | |
| 1 | 20220 | Media, Carbon, Liquid, Virgin, 8 x 30 Coconut | 6000 | --- | |
| EXTRA | lb | Sold in 1100 lb (500 Kg) sacks per pound | 0 | | |
| | Type: I | --- | | 0 | |
| 1 | 9999 | Misc Part, See Details | 2 | --- | |
| EXTRA | ea | As per detailed specification below | 0 | | |
| | Type: P | O-ringsm 4155-1490-B (V6427) | | 0 | |
| 1 | 21891 | Gasket, Flange, Tetrasolv AF Series | 6 | --- | |
| EXTRA | ea | 18" Hatch Gasket | 0 | | |
| | Type: P | Fits, AF250, AF500, AF1000, AF2000, AF300<br>--- | | 0 | |
| 1 | 22353 | Pump, Part, SSH, Mechanical Seal Kit | 2 | --- | |
| EXTRA | ea | P/N: RPKSSHS | 0 | | |
| | Type: P | --- | | 0 | |
| 1 | 21605-T | Media, Coal, Anthracite, .9 to .95mm | 20 | --- | |
| EXTRA | lb | 52 lbs/bag; sold in lbs. | 0 | | |
| | Type: I | --- | | 0 | |
| 1 | 11610 | Container, 8' x 20' x 8'6" | 1 | --- | |
| EXTRA PA | ea | 5-8 yr | 0 | | |
| | Type: P | --- | | 0 | |




**BUILDING EQUIPMENT AND CONTROL PANEL**




WIRING TO BE CLASS I DIVISION 2, AS PER THE CEC.

IS INPUT WIRING TO BE WIRED FOR INDOORS, ACCORDING CEC FOR HAZARDOUS LOCATIONS.

PIPING DETAILS:
- WATER FLOW METERS: PROVIDE 10 DIA. OF STRAIGHT PIPE BEFORE AND 5 DIA. OF STRAIGHT PIPE AFTER METERS. ENSURE THAT THROTTLING VALVES ARE NOT DIRECTLY IN LINE WITH METERS
- AIR FLOW METERS: PROVIDE 8 DIA. OF STRAIGHT PIPE BEFORE AND 3 DIA. OF STRAIGHT PIPE AFTER METERS. IF POSSIBLE. AVOID TEES AND ELBOWS BEFORE AND AFTER METERS.
- MATERIALS OF VALVES AND FITTINGS TO BE THE SAME AS THE DESCRIPTION AT THE LINE. IF THERE IS A TRANSITION FROM PVC TO STEEL, THE VALVE SHOULD BE BRASS
- THERE ARE NO SPECIAL PIPING REQUIREMENTS OTHER THAN WHAT IS EXPLAINED ON THE DIAGRAM
- WHEN PVC HOSE IS SPECIFIED, ALWAYS USE VACUUM HOSE. USE GREEN HOSE FOR PRESSURES LESS THAN 60PSI. USE TANK TRUCK HOSE FOR PRESSURES BETWEEN 60PSI AND 150PSI
- PVC PIPE MAY BE SUBSTITUTED WITH EQUAL-SIZED PVC HOSE WHERE A FLEXIBLE CONNECTION IS PREFERRED

THIS INFORMATION IS THE PROPERTY OF NEWTERRA AND CANNOT BE REUSED OR REPRODUCED WITHOUT THE WRITTEN

| | | | |
|---|---|---|---|
| C | 2013-08-20 | DM | AS BUILT |
| B | 2013-08-06 | DAM | FOR PRODUCTION |

DWG. NO: 102140-01 (PAGE 1 OF 2)

TITLE: PROCESS & INSTRUMENTATION DRAWING

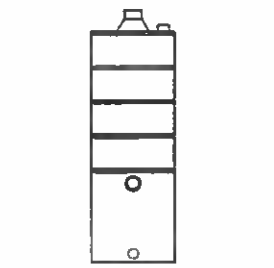
CUSTOMER: MARY RIVER PROJECT BAFFINLAND

newterra LTD.

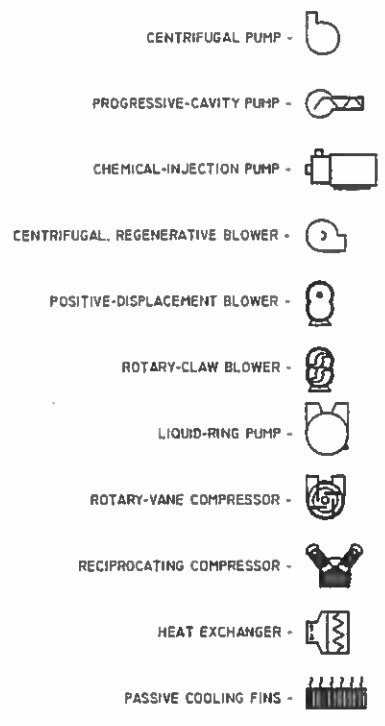
## VALVES AND PIPING

| | NO | NC |
|---|---|---|
| BALL VALVE | | |
| GATE VALVE | | |
| GLOBE VALVE | | |
| NEEDLE VALVE | | |
| SLIDE VALVE | | |
| SOLENOID VALVE | | |
| BUTTERFLY VALVE | | |
| SWING CHECK VALVE | | |
| WAFER CHECK VALVE | | |
| SPRING CHECK VALVE | | |
| WYE STRAINER | | |
| SAMPLE PORT | | |
| PRESSURE RELIEF VALVE | | |
| VACUUM RELIEF VALVE | | |
| CAMLOCK CONNECTION | | |
| FERNCO CONNECTION | | |
| FLEXIBLE CONNECTION | | |
| FLANGED CONNECTION | | |
| REDUCER | | |
| UNION | | |
| ADSORBENT FILTER | | |
| COALESCING FILTER | | |
| PARTICULATE FILTER | | |
| FILTER SILENCER | | |
| PRESSURE REGULATOR | | |
| REGULATOR W/ FILTER | | |

## EQUIPMENT



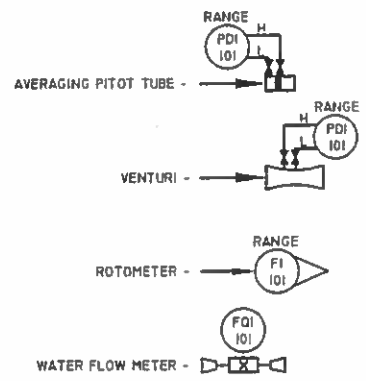

## EQUIPMENT




## EQUIPMENT

AS - AIR STRIPPER
BLD - BUILDING, TRAILER OR SKID
FLT - FILTER VESSEL
LPC - LIQUID-PHASE CARBON VESSEL
MFD - MANIFOLD
OWS - OIL/WATER SEPARATOR
OX - OXIDIZER
PST - PRODUCT STORAGE TANK
SOS - SEAL OIL SEPARATOR
SWS - SEAL WATER SEPARATOR
TNK - TANK
VLS - VAPOR/LIQUID SEPARATOR
VPC - VAPOR-PHASE CARBON VESSEL

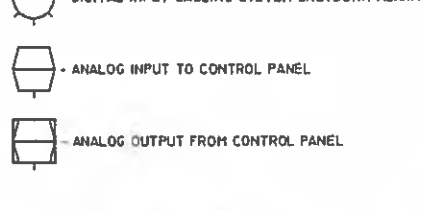
## FLOW MEASUREMENT



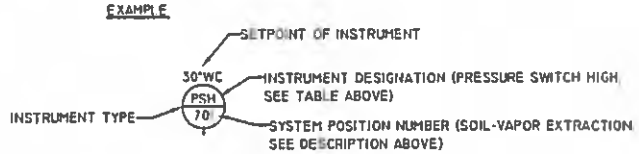

## INSTRUMENT DESIGNATION

| | INPUT | 1ST MODIFIER | 2ND MODIFIER | 3RD MODIFIER | OUTPUT | 1ST MODIFIER | |
|---|---|---|---|---|---|---|---|
| A | | | ALARM | | | | A |
| B | | | | | | BLOWER | B |
| C | CYCLE | | | | | COMPRESSOR | C |
| D | | DIFFERENTIAL | | | | AIR DRYER | D |
| E | | | | | | | E |
| F | FLOW | | | | | FAN | F |
| G | GAS (LEL) | | GAUGE | | | | G |
| H | | | | HIGH | HAND | HEATER | H |
| I | CURRENT | | INDICATOR | | | | I |
| J | | | | | | | J |
| K | | | | | | | K |
| L | LEVEL | | | LOW | | | L |
| M | | | | | MOTORIZED | | M |
| N | | | | | | | N |
| O | | | | | | | O |
| P | PRESSURE | | | | PNEUMATIC | PUMP | P |
| Q | | QUANTITY | | | | | Q |
| R | | | | | | | R |
| S | SPEED | | SWITCH | | SOLENOID | | S |
| T | TEMPERATURE | | TRANSMITTER | | | | T |
| U | | | | | | | U |
| V | | | | | | VALVE | V |
| W | | | | | | | W |
| X | | | | | | | X |
| Y | | | | | | | Y |
| Z | POSITION | | | | | | Z |

## INSTRUMENT IDENTIFICATION




EXAMPLE




## SYSTEM POSITION DESIGNATION

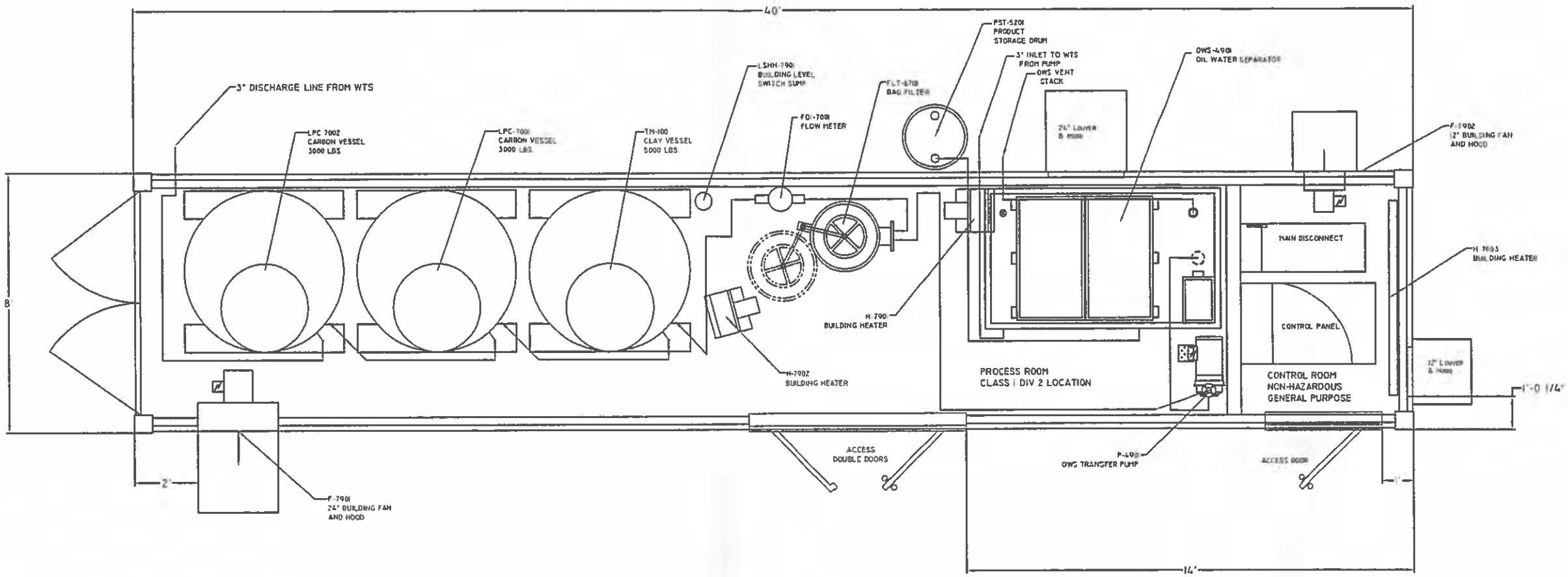
100 - VACUUM INLET MANIFOLD
300 - INLET HEAT EXCHANGER
400 - VAPOR/LIQUID SEPARATOR
500 - VAPOR/LIQUID SEPARATOR - 2
700 - SOIL-VAPOR EXTRACTION
1000 - LIQUID-RING PUMP
1300 - SVE HEAT EXCHANGER
1600 - VAPOR-PHASE CARBON
1900 - OXIDIZER
2200 - AIR SPARGE
2500 - SPARGE HEAT EXCHANGER
2800 - SPARGE OUTLET MANIFOLD
3100 - AIR COMPRESSOR
3400 - COMPRESSED-AIR OUTLET MANIFOLD
3700 - PNEUMATIC WELL PUMPS
4000 - SUBMERSIBLE WELL PUMPS
4300 - SURFACE-MOUNT WELL PUMPS
4600 - GROUNDWATER INLET MANIFOLD
4900 - OIL/WATER SEPARATOR
5200 - PRODUCT STORAGE TANK
5500 - INLET TANK
5800 - UPSTREAM BAG FILTER
6100 - CHEMICAL INJECTION
6400 - AIR STRIPPER
6700 - PRE-CARBON BAG FILTER
7000 - LIQUID-PHASE CARBON
7100 - PRE-MEDIA BAG FILTER
7200 - ACTIVATED ALUMINA
7300 - DISCHARGE TANK
7400 - POST-TREATMENT BAG FILTER
7600 - REINJECTION
7900 - BUILDING, TRAILER OR SKID
8200 - CONTROL PANEL
8500 - ELECTRICAL PARTS
9900 - EXTRAS

PIPING DETAILS
- WATER FLOW METERS: PROVIDE 10 DIA. OF STRAIGHT PIPE BEFORE AND 5 DIA. OF STRAIGHT PIPE AFTER METERS. ENSURE THAT THROTTLING VALVES ARE NOT DIRECTLY IN LINE WITH METERS
- AIR FLOW METERS: PROVIDE 8 DIA. OF STRAIGHT PIPE BEFORE AND 3 DIA. OF STRAIGHT PIPE AFTER METERS, IF POSSIBLE. AVOID TEES AND ELBOWS BEFORE AND AFTER METERS
- MATERIALS OF VALVES AND FITTINGS TO BE THE SAME AS THE DESCRIPTION AT THE LINE. IF THERE IS A TRANSITION FROM PVC TO STEEL, THE VALVE SHOULD BE BRASS.
- THERE ARE NO SPECIAL PIPING REQUIREMENTS OTHER THAN WHAT IS EXPLAINED ON THE DIAGRAM
- WHEN PVC HOSE IS SPECIFIED, ALWAYS USE VACUUM HOSE. USE GREEN HOSE FOR PRESSURES LESS THAN 60PSI. USE TANK TRUCK HOSE FOR PRESSURES BETWEEN 60PSI AND 150PSI
- PVC PIPE MAY BE SUBSTITUTED WITH EQUAL-SIZED PVC HOSE WHERE A FLEXIBLE CONNECTION IS PREFERRED

| | | | | |
|---|---|---|---|---|
| B | 2013-08-06 | DAM | FOR PRODUCTION | |

DWG. NO: 102140-01 (PAGE 2 OF 2)
TITLE: PROCESS & INSTRUMENTATION DRWG LEGEND
CUSTOMER: MARY RIVER PROJECT BAFFINLAND

SCALE BAR, EACH BLOCK IS 12" LONG




PLEASE NOTE. THIS BUILDING IS SHIPPING ON A BOAT AND MUST NOT BE MORE THE 96" IN WIDTH. THIS INCLUDES ALL EQUIPMENT AND CONNECTIONS THAT PROTRUDE THROUGH THE ENCLOSURE.

** CIVIL CONSTRUCTION NOTES **

- BUILDING TO BE PAINTED WITH HEMPATEX HI BUILD 46410 BLUE HEMPEL COLOUR CODE 33930
- DOOR COLOUR TO BE THE SAME AS BUILDING
- FLOOR TO BE GATOR GUARDED
- PROVIDE WOOD LIP AROUND PERIMETER TO ALLOW SUMP SWITCH TO TRIP
- INSTALL GRATING BETWEEN BUILDING FANS AND OUTSIDE LOUVERS.
- THERMAL INSULATION ON WALLS AND CEILING

**MECH /ELECT ASS'Y NOTES **

- MAXIMUM WIDTH FOR SHIPPING IS 96" THIS INCLUDES ALL CONNECTIONS THAT PROTRUDE THROUGH THE SIDES OF THE ENCLOSURE
- PLUG AND SEAL (WITH WASHERS) ANY HOLES IN THE FLOOR TO CONTAIN WATER SPILLS
- LOCATE COOLING THERMOSTAT ON THE WARMEST LOCATION AT CEILING LEVEL.
- LOCATE HEATING THERMOSTAT AT FLOOR LEVEL

*** COMMISSIONING NOTES ***

- NEWTERRA RECOMMENDS PAD BE AT LEAST 12" LARGER THAN ENCLOSURE IN ALL DIRECTIONS LOCAL CODES MAY REQUIRE ALTERNATE DIMENSIONS.
- BUILDINGS NEED TO BE SHIMMED ON SITE TO ALLOW DOORS TO OPEN FREELY PLEASE HAVE SHIMMING MATERIAL READY DURING BUILDING INSTALLATION
- FOR BUILDINGS IN COLD WEATHER CLIMATES WHERE THE BUILDING IS ELEVATED, A SKIRT MUST BE BUILT AROUND THE BASE TO PREVENT THE FLOOR FROM FREEZING.
- [illegible] AND LOUVRE HOODS NEED TO BE INSTALLED [illegible] CANNOT SHIP WITH HOODS ATTACHED

*** DIMENSION INFORMATION ***

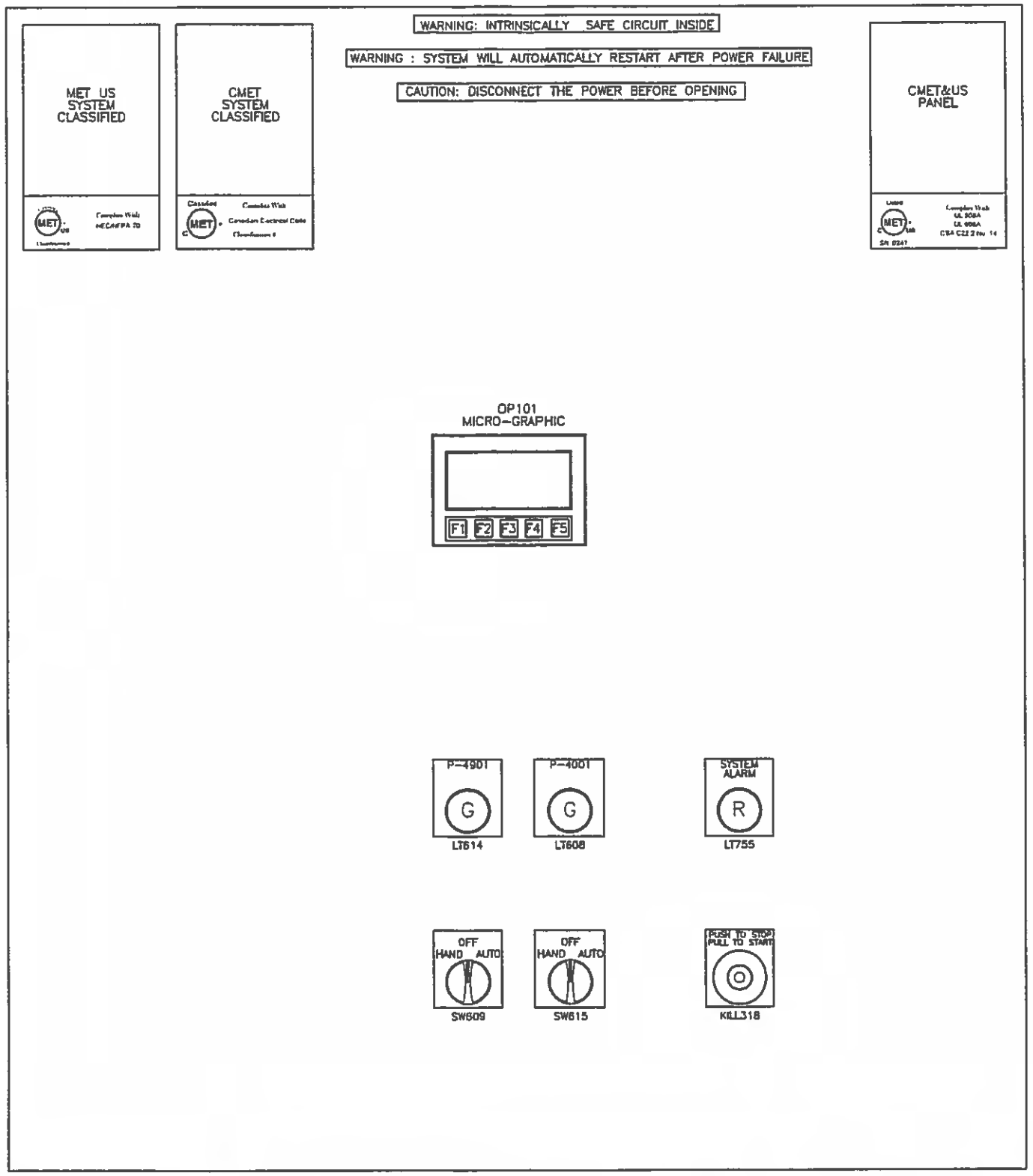
| DESCRIPTION | DIM (L X W X H) | WEIGHT |
|---|---|---|
| 40' CONTAINER | 8' x 42' x 9.5' | ????? |
| | | |
| | | |
| | | |

FLOW DIRECTION
ELECTRICAL CONNECTION
FLOW INTO THE PAGE
FLOW OUT OF THE PAGE
THIS AREA REPRESENTS SERVICE SPACE REQUIRED

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| LEVEL | DATE: | BY | REVISION: |
|---|---|---|---|
| F | 2013-08-20 | DM | AS BUILT FOR 102140 |
| F2 | 2013-08-07 | DM | PRODUCTION RELEASE FOR 102140 |

DWG NO: 102140 - 02
TITLE: SYSTEM LAYOUT
CUSTOMER: BAFFINLAND MARY RIVER PROJECT
newterra LTD.




DS201

MAIN DISCONNECT

200 AMP
125A FUSES
208V 3PH
108 FLA

NOTE 1: NEMA 3R LOCKABLE PANEL(S)

NOTE 2: LIGHTS & SWITCHES MOUNTED ON INNER SWING PANEL DOOR




15A GFI

## WIRE LEGEND

BLACK: POWER
RED: CONTROL
WHITE: NEUTRAL
BLUE: +24VDC & I.S.(Intrinsically Safe)
BL/WH: 0VDC
YELLOW: INTERLOCKS

## NOTES:

MET US CERTIFIED, CONTROL ROOM BUILT TO NEC GENERAL PURPOSE STANDARDS, PROCESS ROOM BUILT TO NEC CLASS 1 DIV 2 STANDARDS, ALL WIRING COMPLETE AND ALL EQUIPMENT PRE-PIPED, FACTORY TESTED AND MOUNTED IN ENCLOSURE.

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| CKD | | |
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Baffinland Iron Mines Corp
Mary River Project/ PM 005

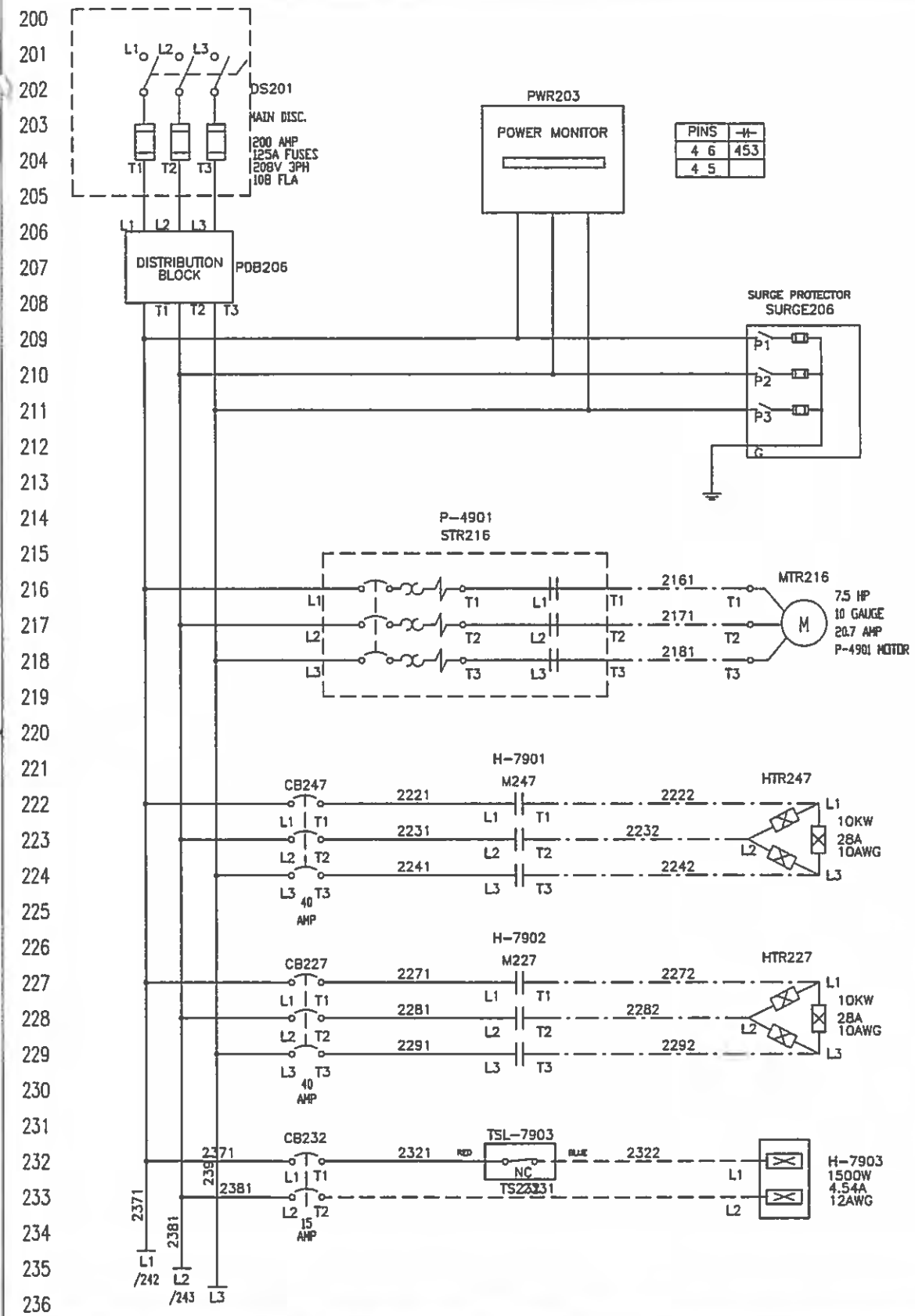
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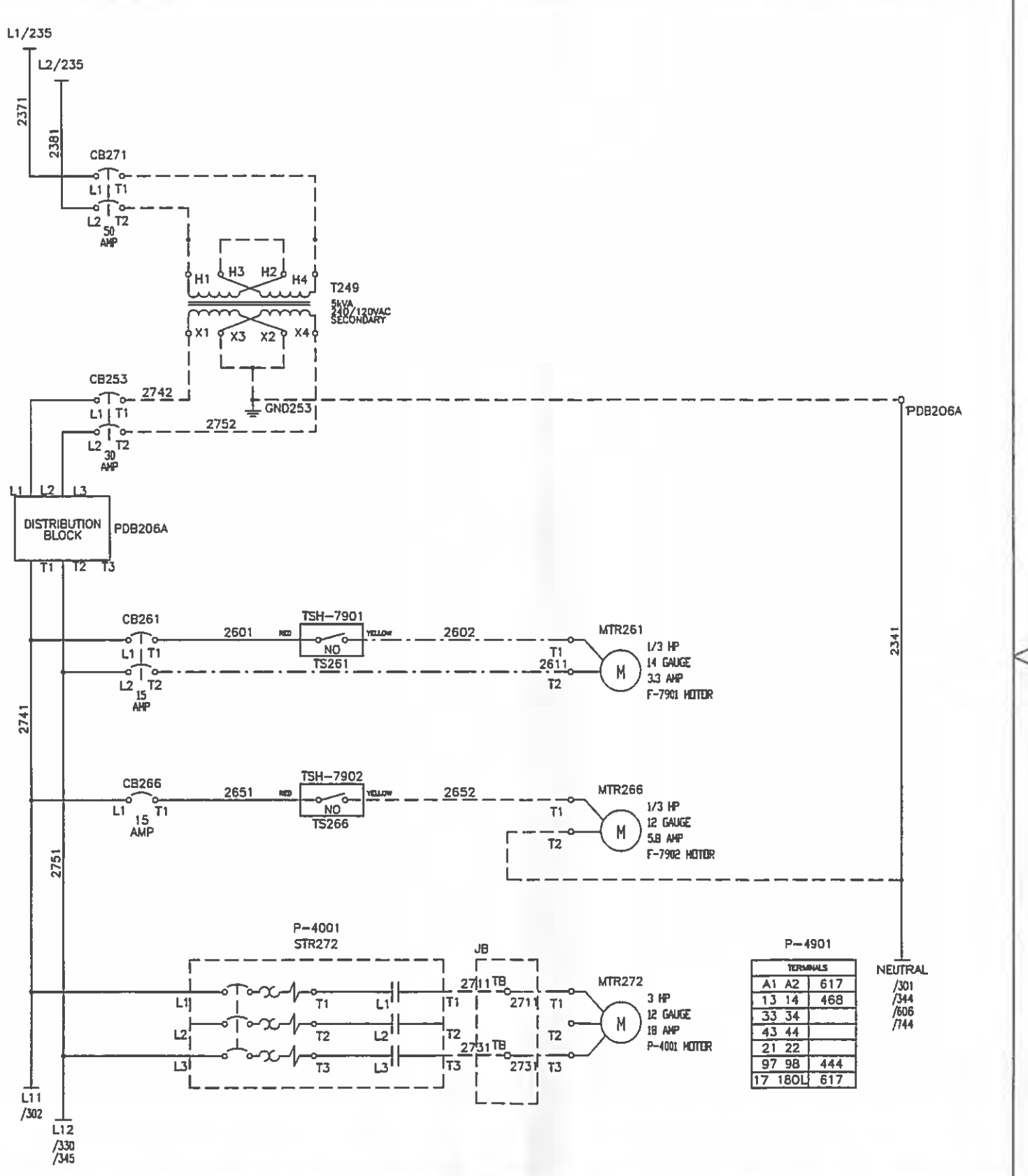
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PAGE DESCRIPTION
PANEL VIEW

PAGE:
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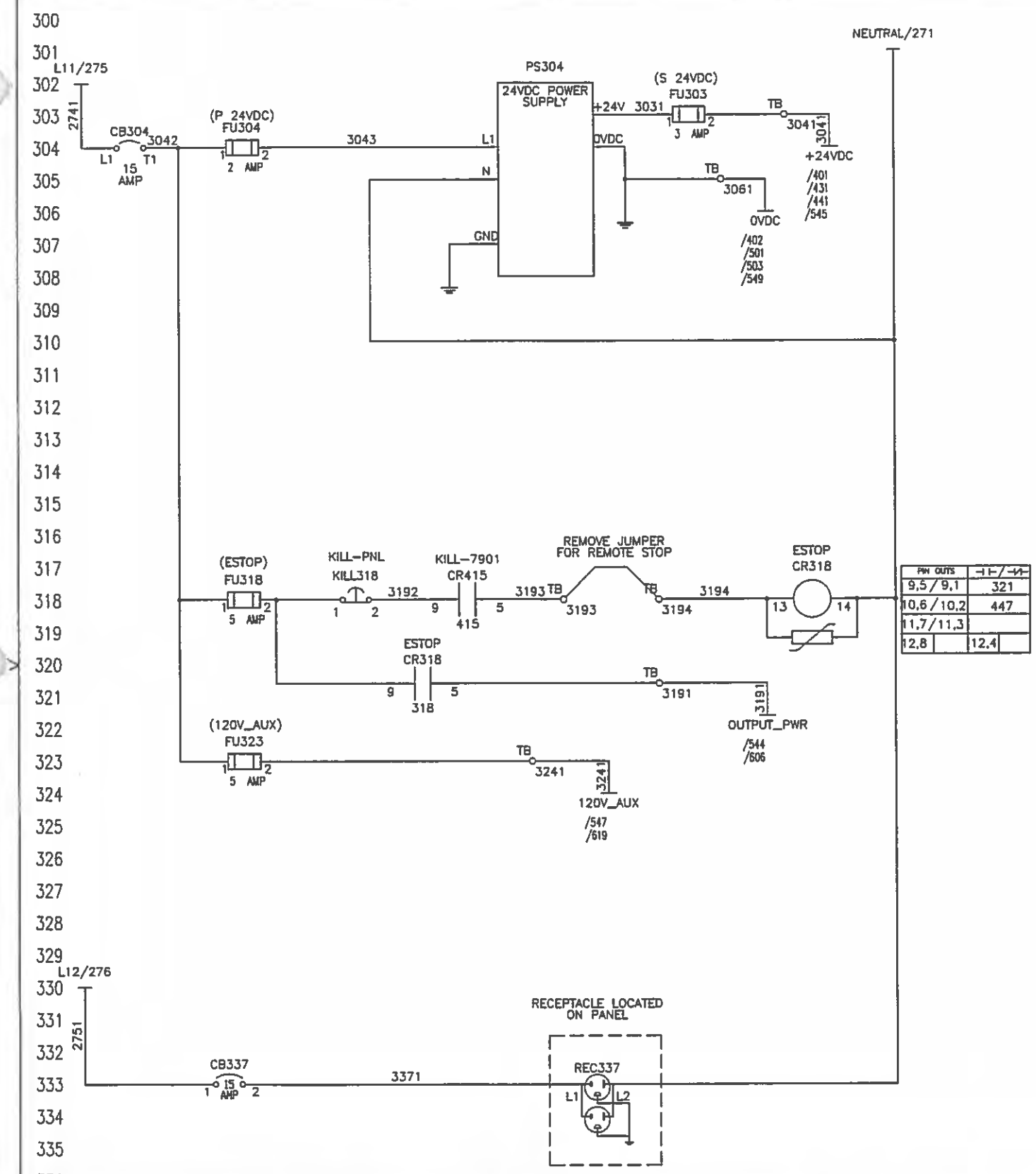
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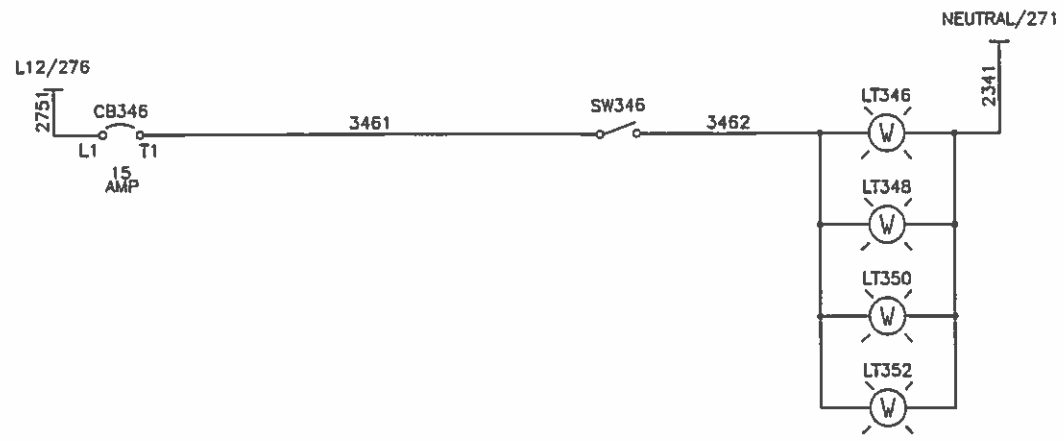
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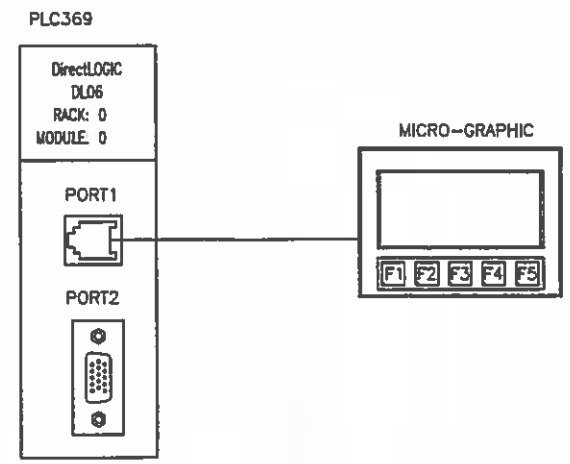
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| PIN OUTS | |
|---|---|
| 9,5/9,1 | 321 |
| 10,6/10,2 | 447 |
| 11,7/11,3 | |
| 12,8 | 12,4 |




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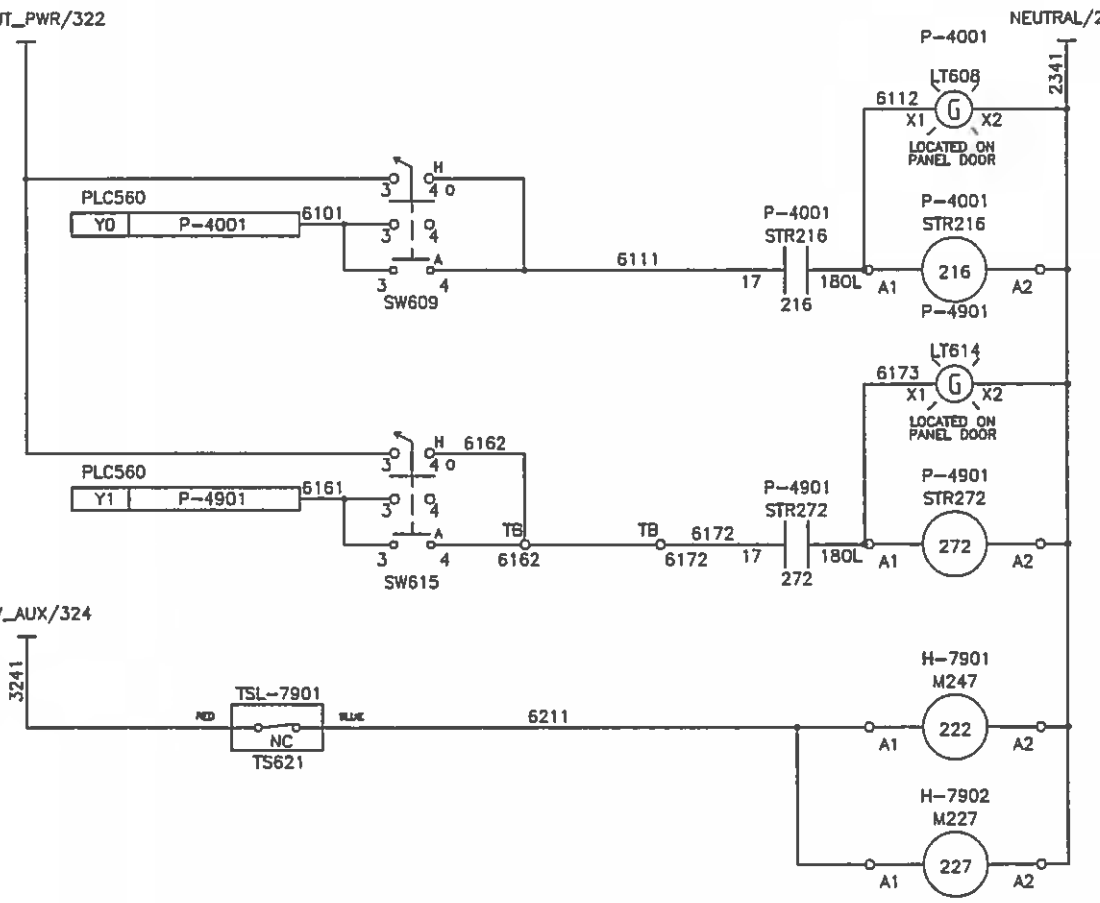
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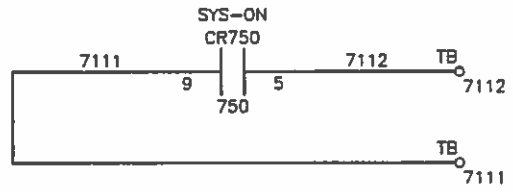
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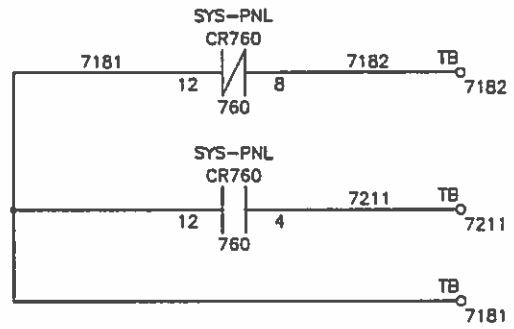
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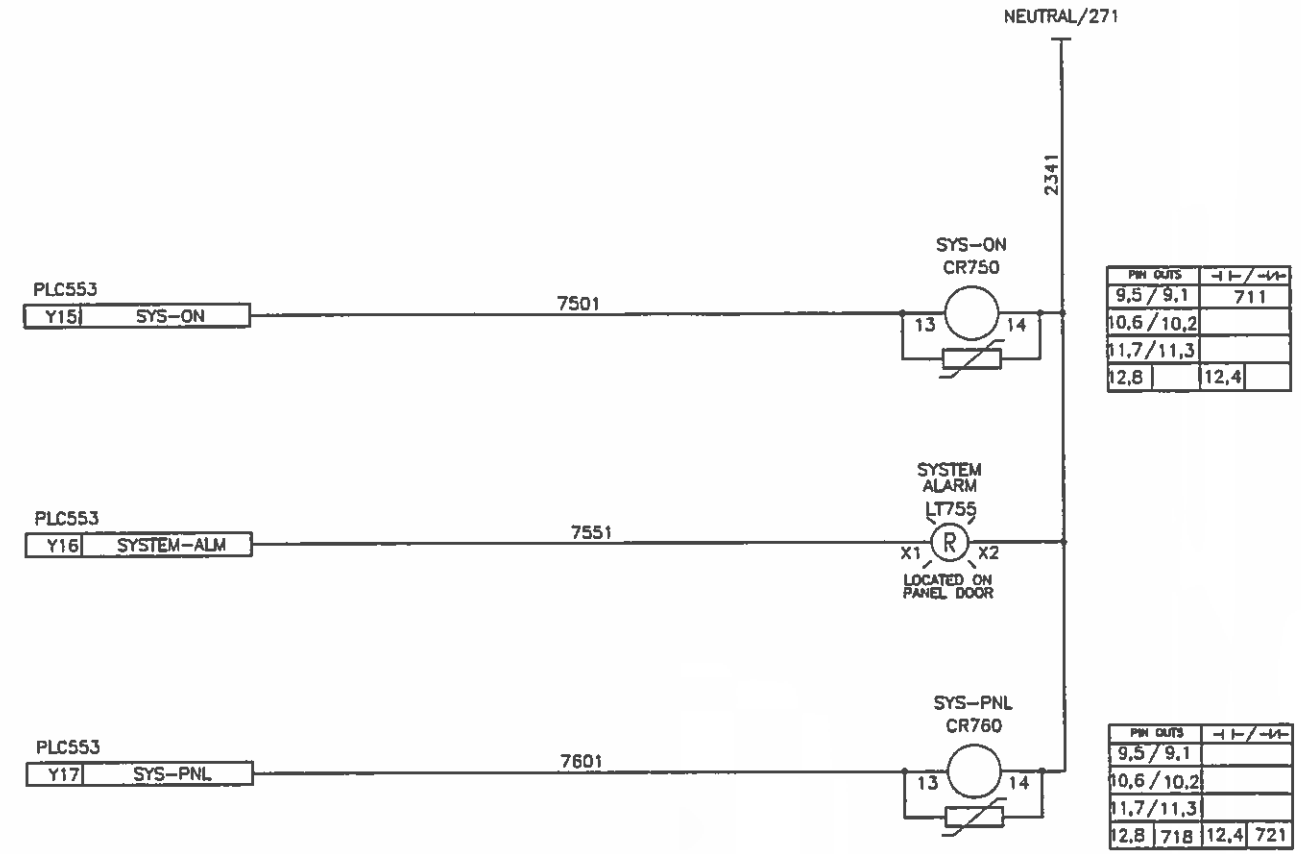
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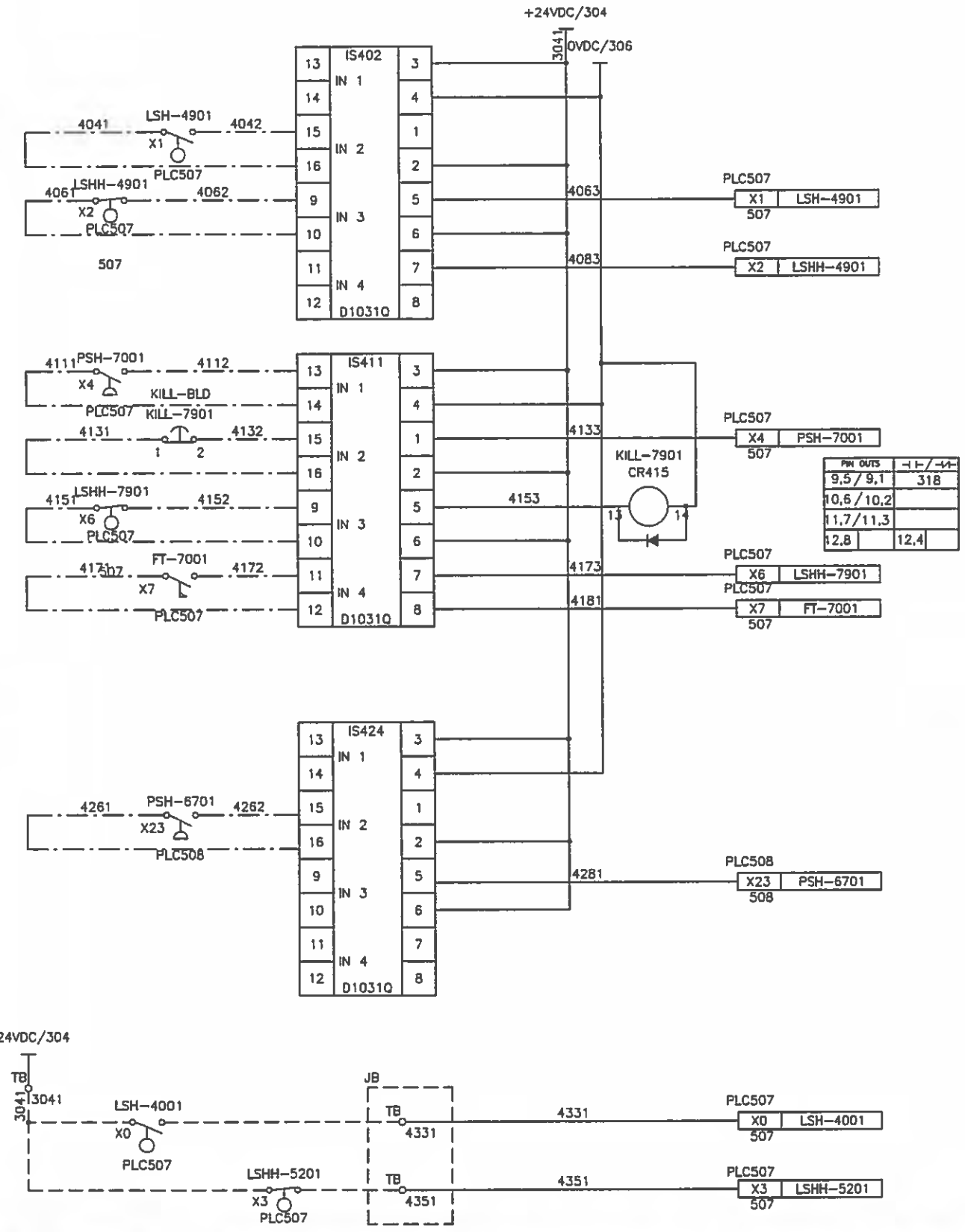
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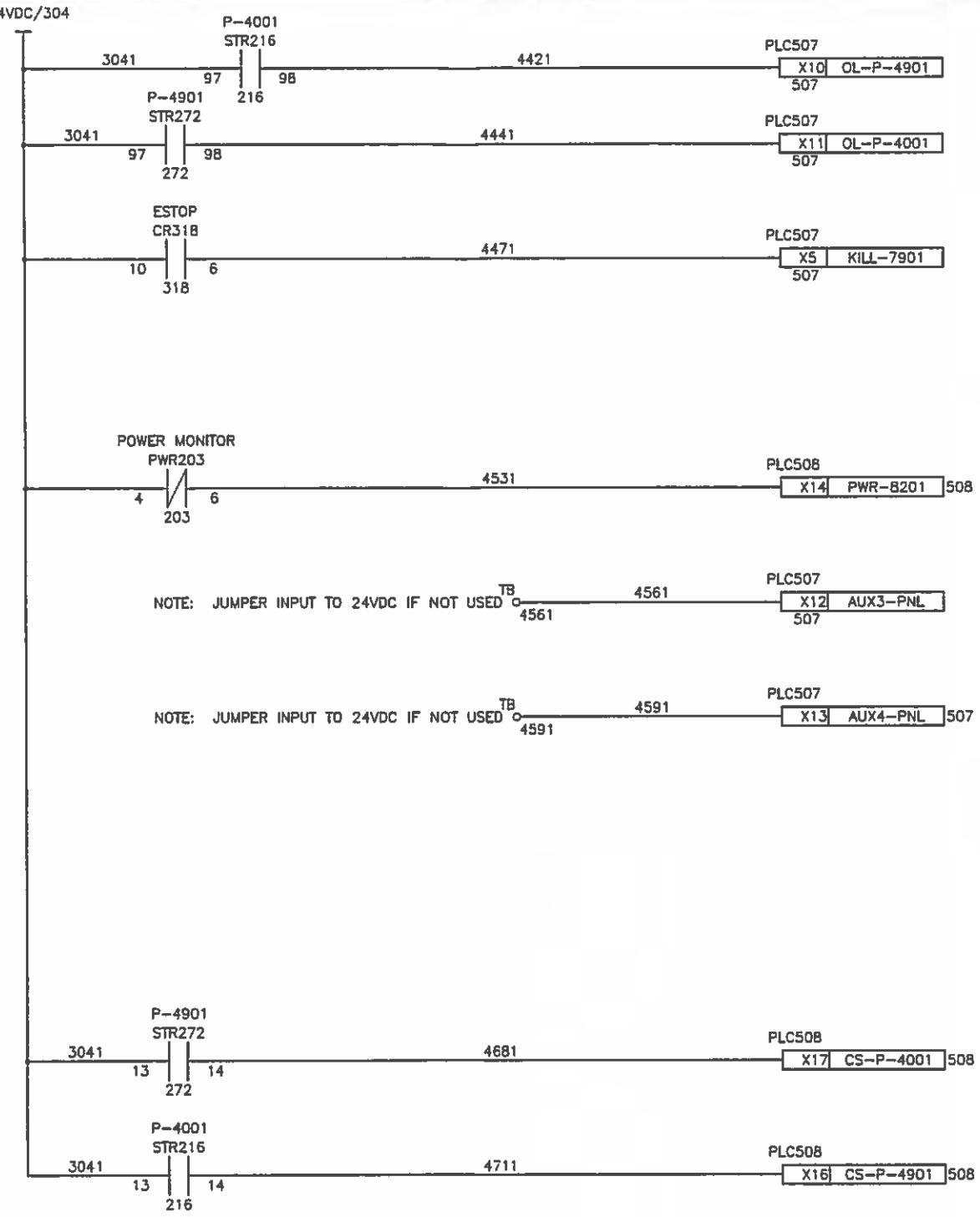
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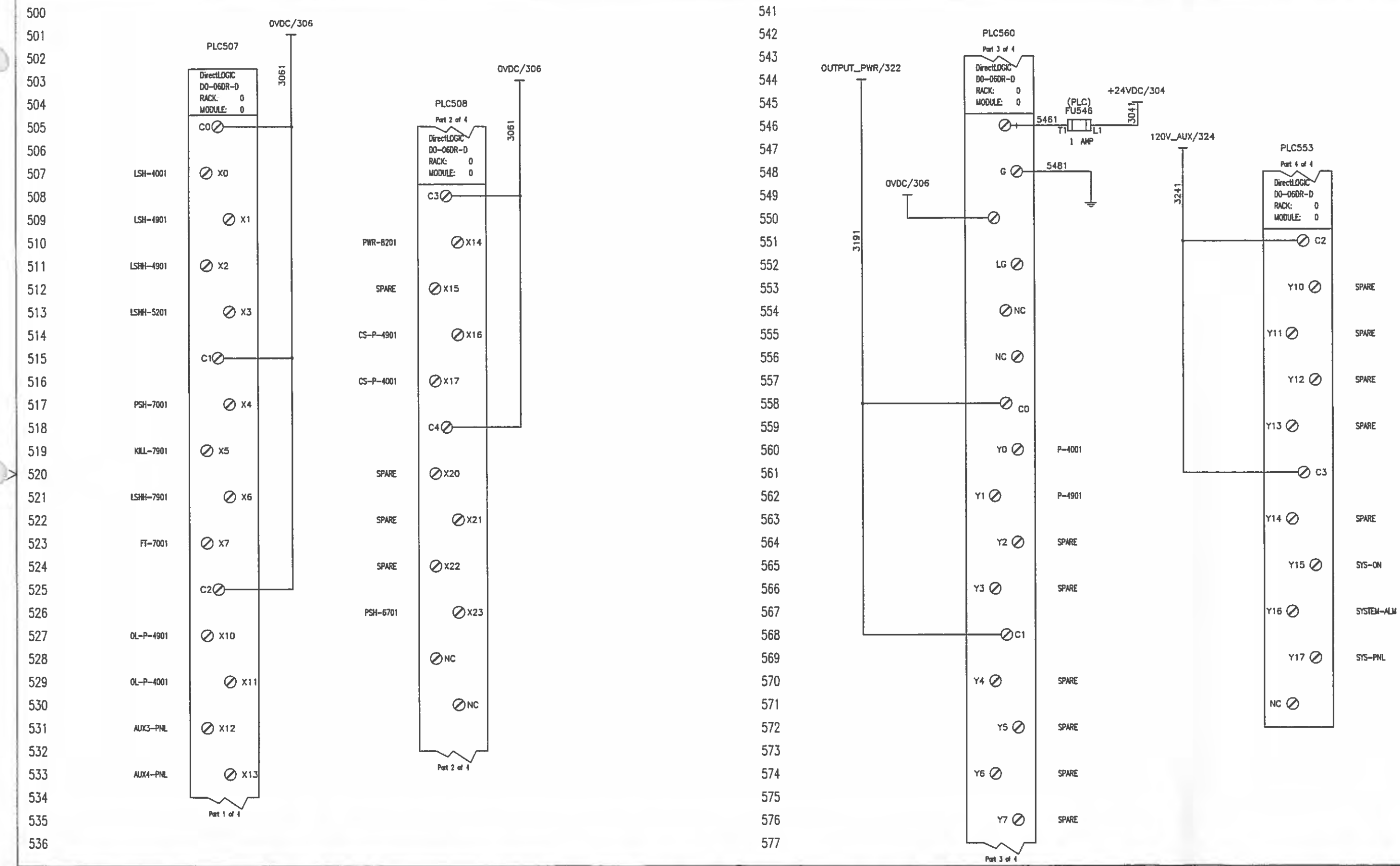
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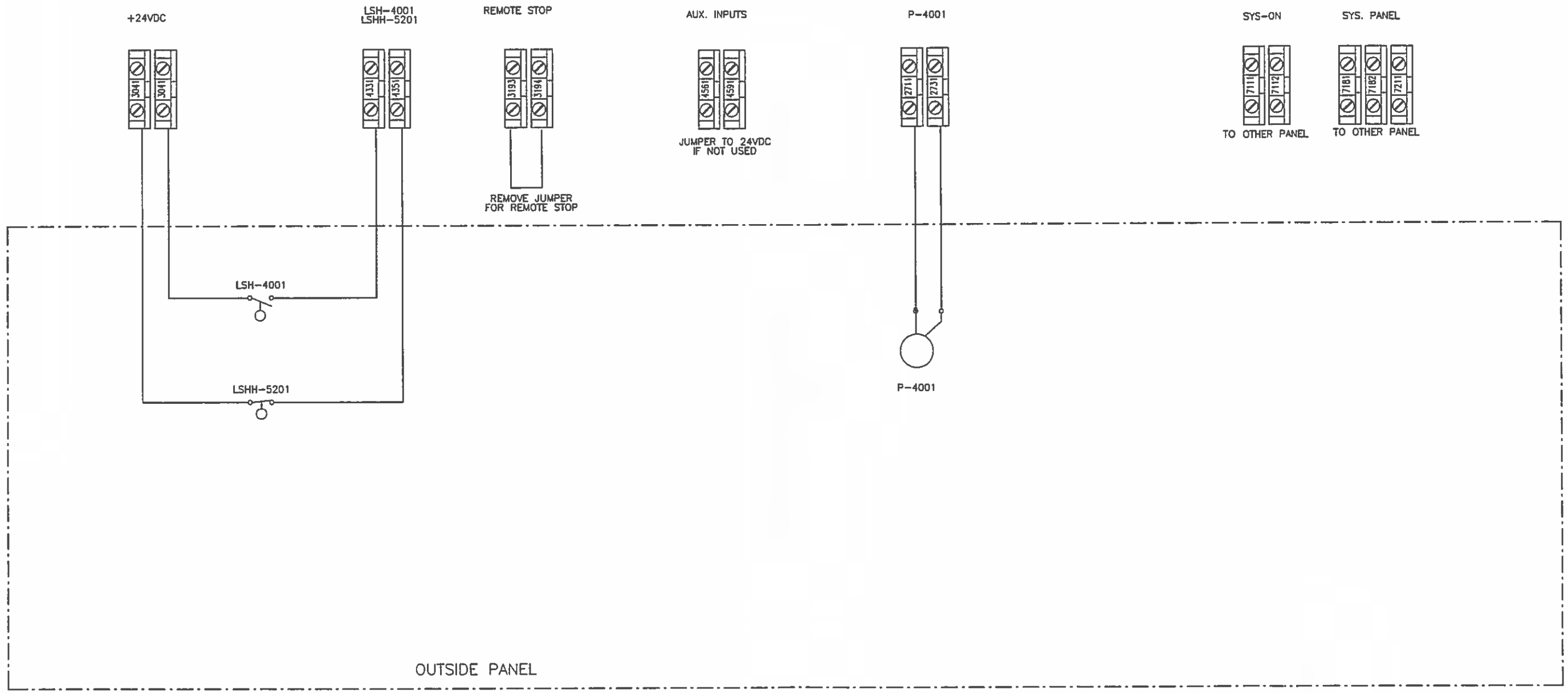
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# TERMINAL PLAN




## WIRE LEGEND

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| | NAME | DATE(mm/dd/yy) |
|---|---|---|
| DRAWN | PR | JUN18/07 |
| CKD | | |
| APPR | | |

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PROJECT:
RTS151 / 150GPM OWS
Baffinland Iron Mines Corp
Mary River Project/ PM005

DRAWING-NO:

JOB-NO:
102140

PAGE DESCRIPTION
FIELD WIRING

PAGE:
8 OF 8

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# *Inputs and Setpoints* — *Project: RTS151 WTS, 150gpm, OWS-24, Carbon, 4*

| *Input Summary* | |
|---|---|
| Digital PLC Inputs: | 15 |
| Digital PLC Frequency: | 1 |
| Analog(4-20) Inputs: | 0 |
| Analog(5V) Inputs: | 0 |
| Analog(10V) Inputs: | 0 |

| *IS Barrier Summary* | |
|---|---|
| Analog IS: | 0 |
| Digital IS : | 9 |

*Legend for Class*

*ISA : Intrinsically Safe Analog*
*ISD: Intrinsically Safe Digital*
*GP: Wire General Purpose*
*D1: Wire as DI/1*
*D2: Wire as DI/2*

| | | | | PLC | | Signal | | | | | | | Datalogger (DLO6) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tag | Name | Type | Class | Input | Value | State | Low | High | Units | SQRT | Fctr | Offsite_Col | Note | Main | Monthly (Daily for 30 days) |
| **Digital_PLC** | | | | | | | | | | | | | | | |
| 4000 Submersible Pump | | | | | | | | | | | | | | | |
| LSH-4001 | Level Switch Hi Well Pump 4001 | Digital_PLC | ISD | X000 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| CS-P-4001 | P-4001 Status | Digital_PLC | GP | X017 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| 4900 Oil/Water Separator | | | | | | | | | | | | | | | |
| LSH-4901 | Level Switch High - Oil Water Separato | Digital_PLC | ISD | X001 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| LSHH-4901 | Level Switch High High - Oil Water Sep | Digital_PLC | ISD | X002 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| CS-P-4901 | P-4901 Status | Digital_PLC | GP | X016 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| 5200 Product Storage Tank | | | | | | | | | | | | | | | |
| LSHH-5201 | Level Switch High High - Product Stora | Digital_PLC | ISD | X003 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| 6700 Bag Filter | | | | | | | | | | | | | | | |
| PSH-6701 | Pressure Switch High Bag Filter 6701 | Digital_PLC | ISD | X023 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| 7000 Liquid Phase Carbon | | | | | | | | | | | | | | | |
| PSH-7001 | High Pressure Switch | Digital_PLC | ISD | X004 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| 7900 Building, Trailer or Skid | | | | | | | | | | | | | | | |
| KILL-7901 | Kill Switch 1 - Building | Digital_PLC | ISD | X005 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| LSHH-7901 | Level Switch High High - Building | Digital_PLC | ISD | X006 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| 8200 Main Control Panel | | | | | | | | | | | | | | | |
| OL-P-4901 | P-4901 Overload | Digital_PLC | GP | X010 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| OL-P-4001 | P-4001 Overload | Digital_PLC | GP | X011 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| AUX-8201 | Auxiliary Contact - Control Panel | Digital_PLC | GP | X012 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| AUX-8202 | Auxiliary Contact - Control Panel | Digital_PLC | | X013 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| PWR-8201 | Power/Phase Monitor Panel | Digital_PLC | | X014 | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| **Digital_PLC_Freq** | | | | | | | | | | | | | | | |
| 7000 Liquid Phase Carbon | | | | | | | | | | | | | | | |
| FT-7001 | Flow Transmitter - Liquid Phase Carbo | Digital_PLC_ | ISD | X007 | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| **Direct** | | | | | | | | | | | | | | | |
| 7900 Building, Trailer or Skid | | | | | | | | | | | | | | | |
| TSH-7901 | Temperature Switch High - Room #1 | Direct | | | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| TSH-7902 | Temperature Switch High - Room #2 | Direct | | | | NormOpen | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |
| TSL-7901 | Temp Switch Low - Room #1 | Direct | | | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |

| | | | | PLC | | Signal | | | | | | | Datalogger (DLO6) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tag | Name | Type | Class | Input | Value | State | Low | High | Units | SQRT | Fctr | Offsite_Col | Note | Main | Monthly (Daily for 30 days) |
| TSL-7902 | Temp Switch Low - Room #2 | Direct | | | | NormClose | 0 | 0 | | ☐ | 0 | | | ☐ 0 | ☐ 0 |

# Outputs Project RTS151 WTS, 150gpm, OWS-24, Carbon, 40

| Largest Motor 7 5 | 575V-3ph: 0<br>460V-3ph: 0<br>230V-3ph: 0<br>208V-3ph: 20.46 | 230V-1ph 11 43<br>208V-1ph 0<br>115V-1ph 12 | 230V/115-3ph 0 |
|---|---|---|---|

| Tag | PLC Loc | Device | Voltage | Watts | HP | Amps | Switches: At Device / On Panel | Panel Setup: Hourmeter / Ammeter | Analog Setup: Signal_Low / Signal_High | Offsite Communication Package: Offsite_Switch / Offsite_Color / Offsite_Name | Hourmeter / Ammeter | Datalog: Monthly / Mai |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Logic | | | | | |
| ***Digital PLC*** | | | | | | | | | | | | |
| *4000* Submersible Pump | | | | | | | | | | | | |
| **P-4001** | Y000 | Motor Cntr | 230V-1ph | | 1.5 | 7 83 | None / Hand/Off/Auto | Display Only / None | | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Well Pump 4001** | | | | | | | PUMPS FEEDING OWS<br>PUMP START: SYSTEM IN RUN AND LAHH-4901 OFF<br>PUMP STOP: SYSTEM NOT IN RUN OR LAHH-4901 ON | | | | | |
| *4900* Oil/Water Separator | | | | | | | | | | | | |
| **P-4901** | Y001 | Motor Cntr | 208V-3ph | | 7.5 | 20 46 | None / Hand/Off/Auto | Display Only / None | | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Pump - Oil Water Separator** | | | | | | | PUMP START: SYSTEM IN RUN AND LSH-4901 ON<br>PUMP STOP: SYSTEM NOT IN RUN OR LSH-4901 OFF | | | | | |
| *8200* Main Control Panel | | | | | | | | | | | | |
| **AL-8201** | Y016 | Light | 115V-1ph | | | | None / None | None / None | | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Alarm Light** | | | | | | | LIGHT ON: SYSTEM IN ALARM.<br>LIGHT OFF: SYSTEM NOT IN ALARM. | | | | | |
| **AR-8201** | Y017 | Relay(110) | 115V-1ph | | | | None / None | None / None | | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Alarm Relay** | | | | | | | RELAY ON: SYSTEM IN SHUTDOWN ALARM.<br>RELAY OFF: SYSTEM NOT IN SHUTDOWN ALARM. | | | | | |
| **SYS ON** | Y015 | Relay(110) | 115V-1ph | | | | None / None | None / None | | | ☐ ☐ | ☐ 0 ☐ 0 |
| **System On Relay** | | | | | | | RELAY ON: SYSTEM IN RUN AND KILL SWITCH NOT PRESSED<br>RELAY OFF: SYSTEM NOT IN RUN OR KILL SWTICH PRESSED | | | | | |
| ***Power*** | | | | | | | | | | | | |
| *7900* Building, Trailer or Skid | | | | | | | | | | | | |
| **F-7901** | | Fan | 230V-1ph | | 0.33 | 3.6 | None / None | None / None | 0 / 0 | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Fan - Process Room** | | | | | | | FAN START: TSH-7901 ON<br>FAN STOP: TSH-7901 OFF | | | | | |
| **F-7902** | | Fan | 115V-1ph | 0 | 0.25 | 2 | None / None | None / None | 0 / 0 | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Fan - Control Room** | | | | | | | FAN START: TSH-7902 ON<br>FAN STOP: TSH-7902 OFF | | | | | |
| **H-7901** | | Heater | 208V/120V-3 | 10000 | 0 | 28 | None / None | None / None | 0 / 0 | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Heater - Process Room #1** | | | | | | | HEATER START: TSL-7901 OFF<br>HEATER STOP: TSL-7901 ON | | | | | |
| **H-7902** | | Heater | 208V/120V-3 | 10000 | | 28 | None / None | None / None | 0 / 0 | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Heater - Process Room #2** | | | | | | | HEATER START: TSL-7901 OFF<br>HEATER STOP: TSL-7901 ON | | | | | |
| **H-7903** | | Heater | 208V/120V-3 | 1500 | 0 | 4.1 | None / None | None / None | 0 / 0 | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Heater - Control Room** | | | | | | | HEATER START: TSL-7902 OFF<br>HEATER STOP: TSL-7902 ON | | | | | |
| **Lights** | | Light | 115V-1ph | 600 | | 5 | None / None | None / None | | | ☐ ☐ | ☐ 0 ☐ 0 |
| **Inside Lights** | | | | | | | LIGHTS ON: LIGHT SWITCH ON<br>LIGHTS OFF: LIGHT SWITCH OFF | | | | | |

| Tag | | PLC Loc | Device | Voltage | Watts | HP | Amps | Switches: At Device | Switches: On Panel | Panel Setup: Hourmeter | Panel Setup: Ammeter | Analog Setup: Signal_Low | Analog Setup: Signal_High | Offsite Communication Package: Offsite_Switch | Offsite_Color | Offsite_Name | Hourmeter | Datalog: Ammeter | Datalog: Monthly | Datalog: Mai |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Logic | | | | | | | | | | | | |
| *1200* | Main Control Panel | | | | | | | | | | | | | | | | | | | |
| | **120V CB** | | Control Powe | 115V-1ph | 600 | | 5 | None | None | None | None | | | | | | ☐ | ☐ | ☐ 0 | ☐ 0 |
| | **120V Control Power** | | | | | | | | | | | | | | | | | | | |

# Alarms Project RTS151 WTS, 150gpm, OWS-24, Carbon, 40' Contai

| Tag | | PLC Loc / Logic | Alarm Type | Delay(sec) | Alarms On.. | Alarm Setting / Comment |
|---|---|---|---|---|---|---|
| **Type:** | **Alarm_PLC** | | | | | |
| 4900 Oil/Water Separator | | | | | | |
| **LAHH-4901** | **High High Level Alarm - Oil Water Separator** | C103 | Recovers | 5 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM IN RUN AND LSHH-4901 OPEN FOR DELAY SHOWN<br>ALARM STOP: SYSTEM RESET | | | | |
| 5200 Product Storage Tank | | | | | | |
| **LAHH-5201** | **High High Level Alarm - Product Storage Tank** | C104 | Sys_Shutdown | 5 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM IN RUN AND LSHH-5201 DEACTIVATED FOR DELAY SHOWN (see table)<br>ALARM STOP: SYSTEM RESET | | | | |
| 5800 Bag Filter | | | | | | |
| **PAH-6701** | **High Pressure Alarm Bag Filter 6701** | C110 | Light_Only | 5 | Open | 0 |
| | | SOFT ALARM:<br>ALARM START: SYSTEM IN RUN AND PSH-6701 ACTIVATED FOR 5 SECONDS<br>ALARM STOP: SYSTEM RESET | | | | |
| 7000 Liquid Phase Carbon | | | | | | |
| **PAH-7001** | **Pressure Alarm High** | C106 | Sys_Shutdown | 5 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM ON AND PSH-7001 OPEN FOR DELAY SHOWN (see table)<br>ALARM STOP: SYSTEM RESET | | | | |
| 7900 Building, Trailer or Skid | | | | | | |
| **KILLA-7901** | **Kill Switch Alarm 1 - Building** | C102 | Sys_Shutdown | 0 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: ANY KILL INPUT OPEN<br><br>ALARM STOP: SYSTEM RESET | | | | |
| **LAHH-7901** | **Level Alarm High High - Building** | C105 | Sys_Shutdown | 5 | Open | 0 |
| | | STANDARD LOGIC<br><br>SYSTEM SHUTDOWN<br>ALARM START: LSHH-7901 OPEN FOR DELAY SHOWN<br>ALARM STOP: SYSTEM RESET | | | | |
| 8200 Main Control Panel | | | | | | |
| **OLA-P-4901** | **Overload Alarm OWS Discharge Pump** | C111 | Sys_Shutdown | 1 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM IN RUN AND OL-P-4901 ACTIVATED<br><br>ALARM STOP: SYSTEM RESET | | | | |

| Tag | | PLC Loc | Alarm Type | Delay(sec) | Alarms On.. | Alarm Setting |
|---|---|---|---|---|---|---|
| | | Logic | | | | Comment |
| **OLA-P-4001** | **Overload Alarm Inlet Discharge Pump** | C112 | Sys_Shutdown | 1 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM IN RUN AND OL-P-4001 ACTIVATED<br><br>ALARM STOP: SYSTEM RESET | | | | |
| **AUXA-8201** | **Auxiliary Alarm - Control Panel** | C113 | Sys_Shutdown | 5 | Open | 0 |
| | | STANDARD LOGIC<br>SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM IN RUN AND AUX-8201 DEACTIVATED<br><br>ALARM STOP: SYSTEM RESET | | | | |
| **AUXA-8202** | **Auxiliary Alarm - Control Panel** | C113 | Sys_Shutdown | 5 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: SYSTEM IN RUN AND AUX-8202 DEACTIVATED<br><br>ALARM STOP: SYSTEM RESET | | | | |
| **PWRA-8201** | **Panel Power Alarm** | C114 | Sys_Shutdown | 0 | Open | 0 |
| | | SYSTEM SHUTDOWN:<br>ALARM START: POWER LOSS OR INCOMING VOLTAGE FAULT<br><br>ALARM STOP: SYSTEM RESET AND INCOMING POWER IS WITHIN LIMITS<br><br>Note. Power limits and tolerance, as well as recovery time is all set locally on device. | | | | |

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# 1 Using the newterra Site-Link: Remote Offsite Telemetry

## 1.1 Document purpose

This document details the various features and functionality of and procedure for logging in to and using the **newterra** Site-Link: Remote Offsite Telemetry portal.

Revision control

| Revision | Author | Date |
|---|---|---|
| Rev 1. Original draft. | T Coates/ W Moulton | 11 April 2012 |
| | | |
| | | |

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## 3 Overview

The **newterra** Site-Link: Remote Offsite Telemetry is a customized software program and hardware configuration which provides a real-time link to a process control system via cellular modem using our secure Site-Link Server.

Site-Link does not require any additional software to be downloaded or installed and simply uses your favourite internet browser* to view your system from anywhere you can get internet and is Operating System independent (ie Windows/ MAC). This means that you have access to your system via your internet browser enabled computer, smart phone or similar device. To access your system simply type the following address into your browser: https://sitelink.newterra.com.

** **newterra** recommends Internet Explorer 8.0® or higher for best performance with 800x600 resolution or higher.*

Site-Link comes with the following features:

- Customized P&ID layout with System Status
- Start/ Stop/ Reset of System
- Manual Control of most system components†
- Data and Alarm logging exports in .csv format
- Alarm History including Current Alarm Status
- Hour Meters for Equipment††
- Customization of all system set points†

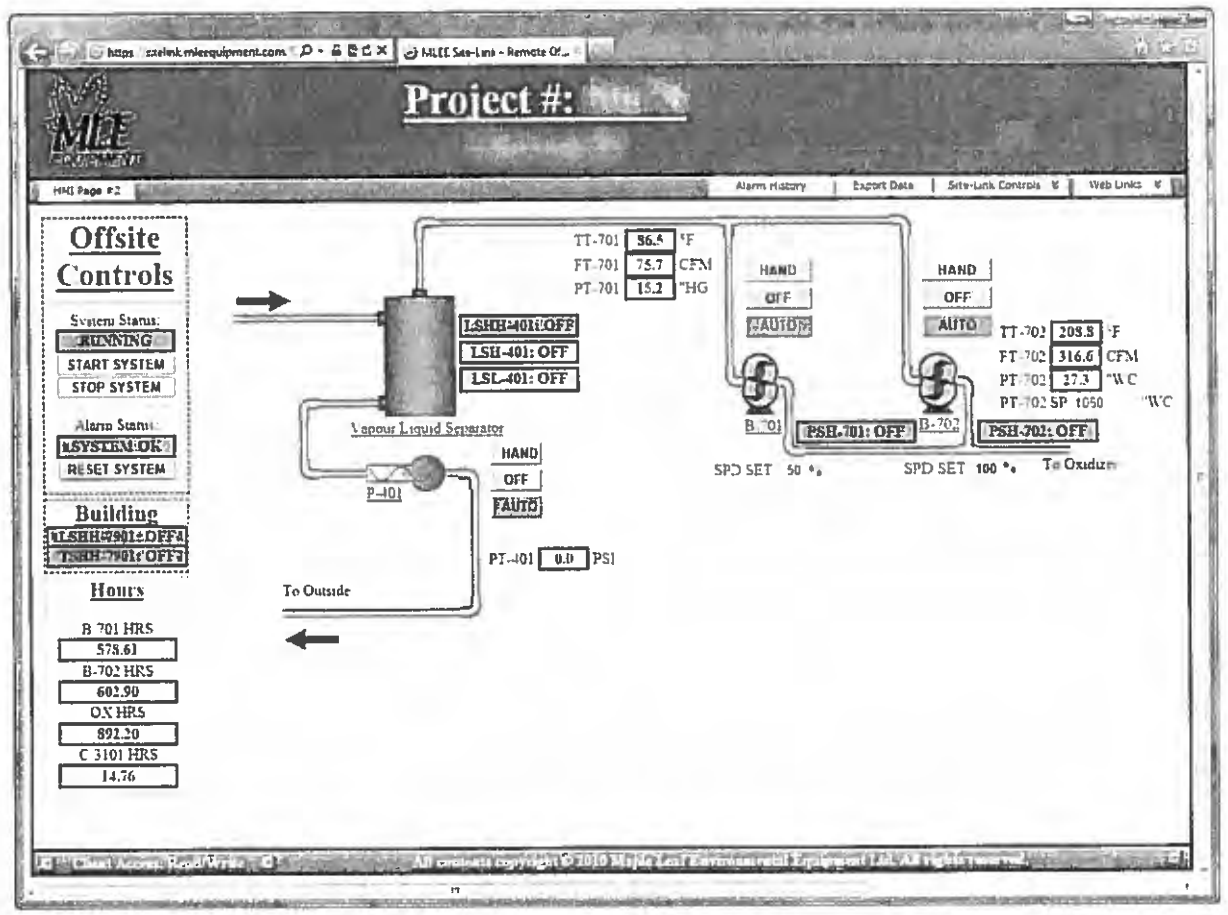
† certain restrictions apply.
†† only applies when hour meters are quoted with system.

Multiple users can have access to Site-Link, each with their own unique login details. Users can have read and write privileges for monitoring and control, or read only privileges for monitoring only. For customers with multiple systems with Site-Link capability, all those systems will be available via the one login account.

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## 4 P&ID Page 1

P&ID page 1 typically includes system status dialog box (Shutdown/ Running). Start and Stop buttons. Reset button to reset alarms. Alarm status box (System OK/ Alarm). Soft HOA switches for motors/ valves etc. Visual indicators for level switches, active pumps/ motors/ valves etc.
Depending on the components used in the system; instantaneous flow, total flow, analog transmitters and SetPoints.
Tabs for P&ID page 2 (if applicable), alarm history and export data.

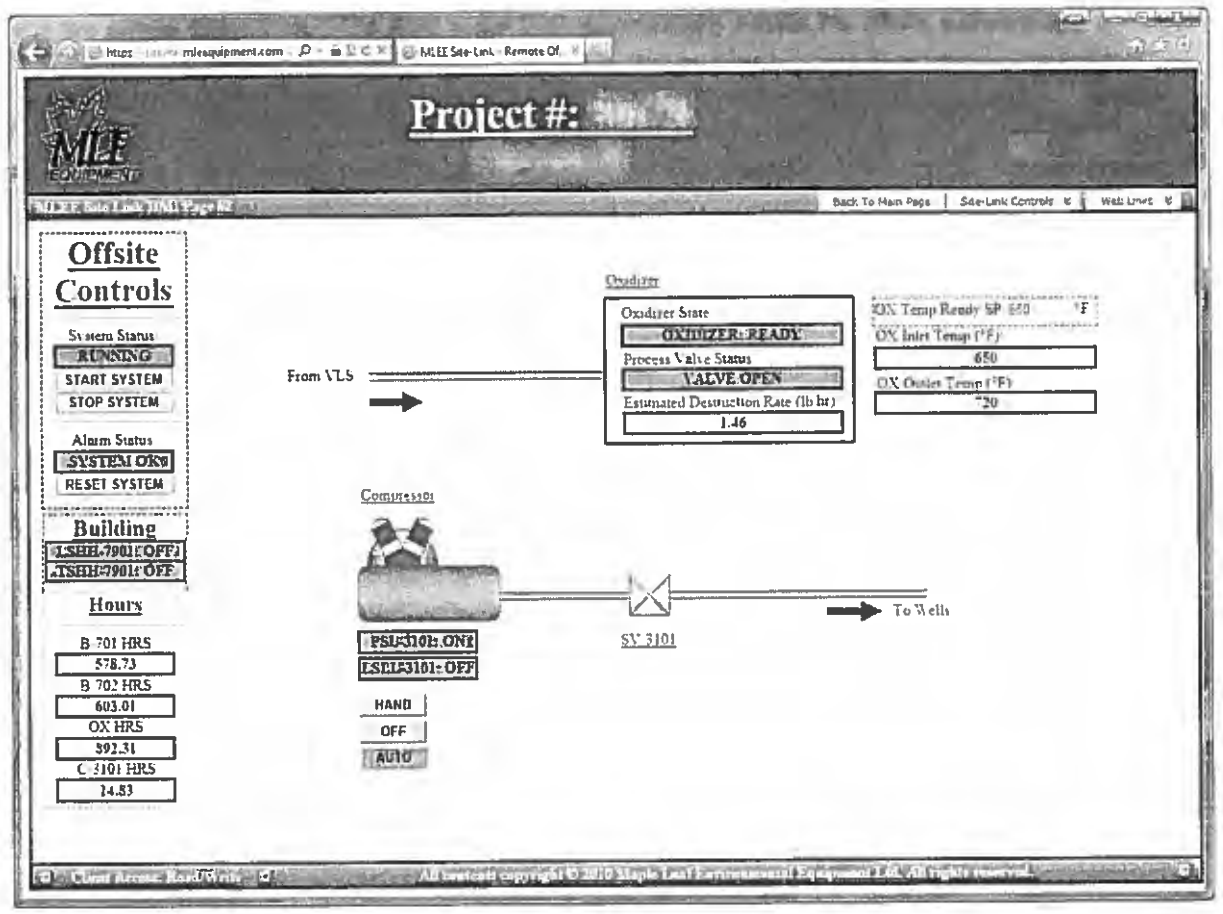



Display refresh rate is once per minute unless a Site-Link button is pressed, in which case the display refresh will be approximately 5 seconds.

To change analog SetPoints simply type into the text box provided and then press the enter key on your computer keyboard.

## 5 P&ID Page 2

P&ID page 2 is typically used for larger systems and includes many or all of the same features as mentioned above, depending on the system.




## 6 Datalogging

Analog values and flow data (if present on the system) and hour meters are logged automatically. If the system only has hour meters the standard logging rate is once per day. If the system has analog values and/ or flow data the standard logging rate is once every 10 minutes.

**Note:** Data is only retained on the server for 90 days before the oldest data starts to be overwritten by the newest data. Therefore it is recommended that downloads are performed every 2 months (see Export Data section below).

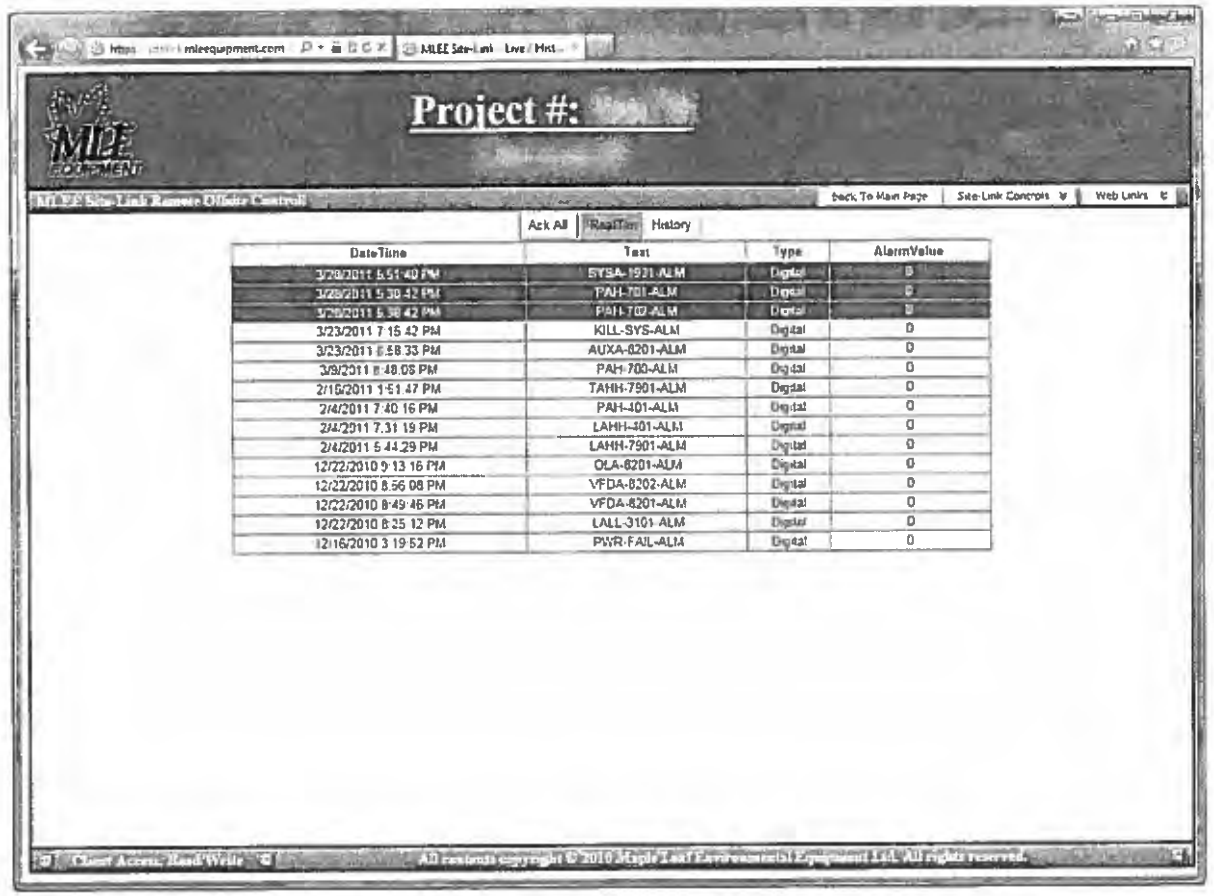
## 7 Yellow/ orange boxes with ?????

Yellow/ orange boxes with ????? instead of the usual red/ green boxes means the Site-Link server is unable to pull any data from the PLC on site. This typically means there is no power to the control panel or possibly an issue with the wireless signal or modem. If symptoms persist please call **newterra**.

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## 8 Alarm History

This is a list of all the alarms the system is capable of generating, in the order that the alarm status last changed. It details the last date/ time that alarm changed state. For more detailed alarm history the alarm export data download can be performed.

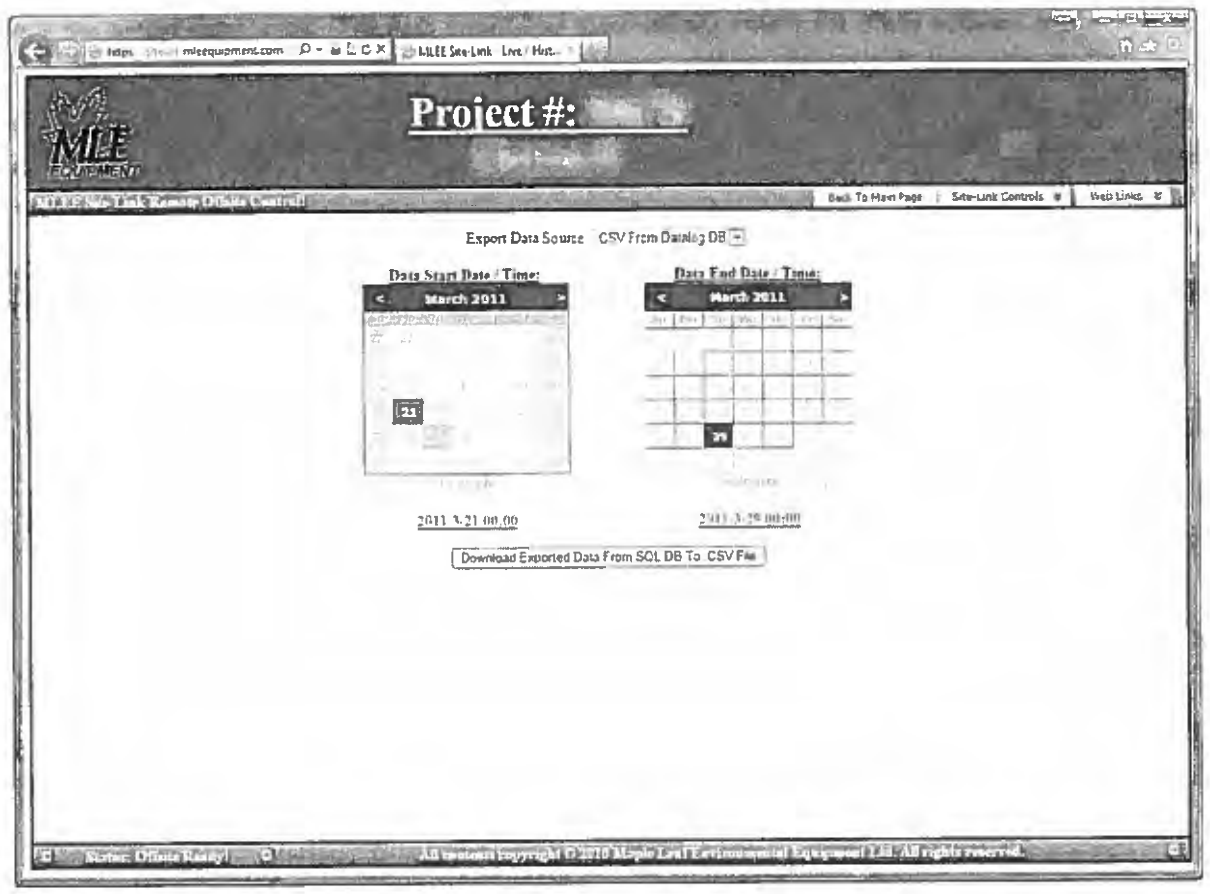



**DateTime:** Date and time the alarm status changes. (**Note:** All times are taken from the Site-Link server clock which is Eastern Time, EST or EDT depending on the time of year).
**Text:** Short form alarm code. Please refer to O&M manual for more detailed description.
**Type:** This will always display Digital.
**AlarmValue:** 0 indicates that the alarm is inactive. 1 indicates that the alarm is active.
**Colour:** Yellow indicates alarm statuses that have been acknowledged, even if the alarm is still active. Red indicates alarm statuses that have not been acknowledged since it last changed state, even if the alarm is no longer active (so red does not necessarily mean the alarm is active, just that it has changed state since it was last acknowledged).
**Ack All:** This will acknowledge all the alarms in the table and turn all the lines yellow, whether the alarm is active or inactive. Please note that this does not physically cancel or reset any alarms on the subject system. An active alarm that has been acknowledged and is displayed on a yellow line will change to a red line once the alarm deactivates, as the alarm has changed state.
**History:** Provides limited alarm history, it is recommended to use the alarm Export Data download outlined in the next section.

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## 9 Export Data

Data and/ or alarm logs can be downloaded for recording, reporting or trending purposes. **Note:** Data is only retained on the server for 90 days before oldest data starts to be overwritten by the newest data. Therefore it is recommended that downloads are performed every 2 months.




**Select data source:** Select the data export source from the drop down box, either Datalog DB or Alarm DB.
**Select Start Date/ Time:** Select the start date by navigating the Data Start Date/ Time calendar to the desired year/ month and click on the day. Set the desired start time in the box below the calendar. (**Note:** All times are taken from the Site-Link server clock which is Eastern Time, EST or EDT depending on the time of year).
**Select End Date/ Time:** Select the end date by navigating the Data End Date/ Time calendar to the desired year/ month and click on the day. (**Note:** You have to click on the day even if it is today's date, as today's date will always be highlighted and it looks like it is highlighted but it is not). Set the desired start time in the box below the calendar. (**Note:** All times are taken from the Site-Link server clock which is Eastern Time, EST or EDT depending on the time of year).
**Download Data:** Click on the 'Download Exported Data From SQL DB To .CSV File' button. When prompted by the File Download dialog box click on the Save button to save the .csv file and then navigate to the location you want to save the file to.

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## 10 Sample Data Download snap shot

Copy and paste from a data download .csv file from a system with only hour meters.

| DateAndTime | V_STATUS | C3101_HRS | C3201_HRS | P4901_HRS | B6401_HRS | P6401_HRS |
|---|---|---|---|---|---|---|
| 3/13/2012 12:00:00 AM | 2 | 73 | 159 | 6 | 0 | 0 |
| 3/14/2012 12:00:00 AM | 2 | 76 | 165 | 6 | 0 | 0 |
| 3/15/2012 12:00:00 AM | 2 | 81 | 173 | 6 | 0 | 0 |
| 3/16/2012 12:00:00 AM | 2 | 86 | 180 | 6 | 0 | 0 |
| 3/17/2012 12:00:00 AM | 2 | 90 | 187 | 7 | 0 | 0 |
| 3/18/2012 12:00:00 AM | 2 | 95 | 195 | 7 | 0 | 0 |
| 3/19/2012 12:00:00 AM | 2 | 99 | 202 | 7 | 0 | 0 |
| 3/20/2012 12:00:00 AM | 2 | 103 | 209 | 7 | 0 | 0 |
| 3/21/2012 12:00:00 AM | 2 | 109 | 217 | 7 | 0 | 0 |
| 3/22/2012 12:00:00 AM | 102 | 112 | 220 | 7 | 0 | 0 |
| 3/23/2012 12:00:00 AM | 114 | 113 | 221 | 7 | 0 | 0 |
| 3/24/2012 12:00:00 AM | 1 | 116 | 225 | 8 | 0 | 0 |
| 3/25/2012 12:00:00 AM | | | | | | |
| 3/26/2012 12:00:00 AM | 1 | 116 | 225 | 8 | 0 | 0 |
| 3/27/2012 12:00:00 AM | 2 | 119 | 228 | 9 | 0 | 0 |
| 3/28/2012 12:00:00 AM | 2 | 126 | 235 | 12 | 0 | 0 |
| 3/29/2012 12:00:00 AM | 2 | 132 | 242 | 15 | 0 | 0 |
| 3/30/2012 12:00:00 AM | 2 | 139 | 249 | 18 | 0 | 0 |
| 3/31/2012 12:00:00 AM | 2 | 145 | 254 | 20 | 0 | 0 |
| 04/01/2012 0:00 | 2 | 151 | 261 | 23 | 0 | 0 |
| 04/02/2012 0:00 | 2 | 158 | 268 | 26 | 0 | 0 |
| 04/03/2012 0:00 | 2 | 164 | 275 | 29 | 0 | 0 |
| 04/04/2012 0:00 | 2 | 170 | 282 | 32 | 0 | 0 |
| 04/05/2012 0:00 | 105 | 177 | 288 | 35 | 0 | 0 |
| 04/06/2012 0:00 | 105 | 183 | 294 | 37 | 0 | 0 |
| 04/07/2012 0:00 | 105 | 189 | 301 | 40 | 0 | 0 |
| 04/08/2012 0:00 | 105 | 196 | 307 | 42 | 0 | 0 |
| 04/09/2012 0:00 | 105 | 202 | 313 | 43 | 0 | 0 |

**DateAndTime**: Date and time data log was taken (Eastern Time). If there are no values for a particular data log date/ time then the server was unable to connect to the system (eg power outage at the system).
**V_STATUS**: Internal PLC status bit used by Site-Link to determine whether the system is running (2), stopped (1) or in alarm (other value).
**C3101_HRS**: Accumulated run time hours for component.

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## 11 Sample Alarm Download snap shot

Cut and paste from alarm download .csv file.

| AlarmID | AlarmType | AlarmGroup | Priority | AlarmText | Active | Acked | TimeDelay | AlarmValue | ClearedValue | AlarmDateTime |
|---|---|---|---|---|---|---|---|---|---|---|
| 200213.C-SYSTEM-KILL-ALM_Dig | Digital | ALM200213 | 0 | SYSTEM-KILL-ALM | TRUE | FALSE | 0 | 1 | | 3/21/2012 10:02:22 AM |
| 200213.C-SYSTEM-KILL-ALM_Dig | Digital | ALM200213 | 0 | SYSTEM-KILL-ALM | TRUE | FALSE | 0 | 0 | | 3/22/2012 5:13:44 PM |
| 200213.C-CGA-3101-ALM_Dig | Digital | ALM200213 | 0 | CGA-3101-ALM | TRUE | FALSE | 0 | 1 | | 3/22/2012 7:26:07 PM |
| 200213.C-CGA-3101-ALM_Dig | Digital | ALM200213 | 0 | CGA-3101-ALM | TRUE | FALSE | 0 | 0 | | 3/23/2012 8:16:04 AM |
| 200213.C-SYSTEM-KILL-ALM_Dig | Digital | ALM200213 | 0 | SYSTEM-KILL-ALM | TRUE | FALSE | 0 | 1 | | 3/23/2012 8:25:28 AM |
| 200213.C-SYSTEM-KILL-ALM_Dig | Digital | ALM200213 | 0 | SYSTEM-KILL-ALM | TRUE | FALSE | 0 | 0 | | 3/23/2012 8:25:41 AM |
| 200213.C-LALL-3101-ALM_Dig | Digital | ALM200213 | 0 | LALL-3101-ALM | TRUE | FALSE | 0 | 1 | | 3/23/2012 10:36:42 AM |
| 200213.C-LALL-3101-ALM_Dig | Digital | ALM200213 | 0 | LALL-3101-ALM | TRUE | FALSE | 0 | 0 | | 3/23/2012 11:03:57 AM |
| 200213.C-LAHH-4901-ALM_Dig | Digital | ALM200213 | 0 | LAHH-4901-ALM | TRUE | FALSE | 0 | 1 | | 3/23/2012 11:04:03 AM |

**AlarmID**: Short form alarm code. Please refer to O&M manual for more detailed description.
**AlarmType**: Will always will report Digital. Unable to suppress column.
**AlarmGroup**: Will always report ALMxxxxxx. Unable to suppress column.
**Priority**: Will always report zero. Unable to suppress column.
**AlarmText**: Short form alarm code. Please refer to O&M manual for more detailed description.
**Active**: Will always report True. Unable to suppress column.
**Acked**: Will always report False. Unable to suppress column.
**TimeDelay**: Will always report zero. Unable to suppress column.
**AlarmValue**: 1 means alarm is/ became active. 0 means alarm is/ became inactive.
**ClearedValue**: Will always be blank. Unable to suppress column.
**AlarmDateTime**: Date and time at which alarm changed state (became active and/ or inactive)

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## 12 PLC Program Changes

Wireless telemetry also enables **newterra** to perform remote PLC program/ system troubleshooting and upload PLC program modifications remotely.

## 13 Logging in

Each user is added to the Site-Link database and set up with an account by an Administrator at **newterra**. Once this has been done the user will receive an automated Email similar to the one shown below.

*From: MLEE Site-Link Admin <sitelink@newterra.com>*
*Date: 12 April 2012 08:11*
*Subject: Re: New User Account Created For: jsmith*
*To: jsmith <jsmith@email.com>*

*Site-Link Account Information*
*----------*

*Project # / Username: jsmith*
*Contact E-Mail Address: jsmith@email.com*

*----------*
*New Random Password: 96a35b*
*----------*

*Please feel free to return to https://sitelink.newterra.com to change your password at any time*

*----------*
*Thank You Very Much For Using The **newterra** Site-Link Offsite Software,*

*~The Site-Link Administrator*

Multiple users can have access to Site-Link, each with their own unique login details. Users can have read and write privileges, for monitoring and control, or read only privileges for monitoring only. For customers with multiple systems with Site-Link capability, all those systems will be available with the one login.

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## 14 E-Alarm

An instant Email or Email to cell phone text is optionally available as a separate service. Personnel on the call out list will receive an automated Email or text similar to the one shown below.

*From: 200000 - ABC Air Sparge [mailto:plc@newterra.com]*
*Sent: April 13, 2012 8:33 AM*
*To: plc201217*
*Subject: ALARM! 200000 - ABC Airsparge*

*C103 - PAH-2401 SPG1*
*04/13/12,12:32PM*
*Help: http://goo.gl/upNS6*

### 14.1 E-Alarm Re-Email

Any alarm condition will re-Email every 2 hours (unless specified otherwise by the customer) until the alarm either self clears (if it is recoverable) or is reset via the Site-Link P&ID page.

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## 15 E-Monitor

A daily system status Email is optionally available as a separate service. Personnel on the call out list will receive a daily automated Email similar to the ones shown below, the more complex the system the more detailed the report.

newterra

### Site-Link E-Monitor

Daily Report for

Start: 3-19-2012 EST  Stop: 3-19-2012 EST

SYSTEM STATUS **ALARM**

| Date-Time (EST) | Status | System (hours) | B-6401 (hours) | P-4901 (hours) | P-6401 (hours) | P-7301 (hours) | Total Water Discharge FT-7301 (gal) | Total Product Discharge FT-5201 (gal) | Total Inlet Fluids FT-4601 (gal) | pH | DWS LT-4901 (%) | PT-4901 (psi) | PDT-6401 ("WC) | PDT-6402 ("WC) | PT-6401 ("WC) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-19-2012 2:22:00 PM | RUNNING | 1151 | 1121 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 46 | 78 | 0.8 | 15.4 | 59 |
| 3-19-2012 2:22:30 PM | RUNNING | 1151 | 1121 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 47 | 78 | 0.7 | 15.4 | 59 |
| 3-19-2012 2:23:00 PM | RUNNING | 1151 | 1121 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 49 | 78 | 0.7 | 15.4 | 59 |
| 3-19-2012 2:23:30 PM | RUNNING | 1151 | 1122 | 66 | 93 | 35 | 327690 | 0 | 0 | 79 | 51 | 78 | 0.7 | 15.4 | 59 |
| 3-19-2012 2:24:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 52 | 78 | 0.7 | 15.4 | 59 |
| 3-19-2012 2:24:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 54 | 78 | 0.8 | 15.3 | 59 |
| 3-19-2012 2:25:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 55 | 78 | 0.8 | 15.3 | 59 |
| 3-19-2012 2:25:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 55 | 78 | 0.8 | 15.3 | 59 |
| 3-19-2012 2:26:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 57 | 78 | 0.7 | 15.3 | 59 |
| 3-19-2012 2:26:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 58 | 78 | 0.7 | 15.3 | 59 |
| 3-19-2012 2:27:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 59 | 78 | 0.7 | 15.3 | 59 |
| 3-19-2012 2:27:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 60 | 78 | 0.8 | 15.3 | 59 |
| 3-19-2012 2:28:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 38 | 78 | 0.8 | 15.3 | 59 |
| 3-19-2012 2:28:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 20 | 78 | 0.7 | 14.7 | 58 |
| 3-19-2012 2:29:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 18 | 78 | 0.7 | 14.7 | 58 |
| 3-19-2012 2:29:30 PM | RUNNING | 1151 | 1122 | 66 | 93 | 35 | 327690 | 0 | 0 | 79 | 16 | 78 | 0.6 | 15.3 | 59 |
| 3-19-2012 2:30:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 19 | 78 | 0.6 | 15.3 | 59 |
| 3-19-2012 2:30:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 21 | 78 | 0.7 | 15.3 | 59 |
| 3-19-2012 2:31:00 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 23 | 78 | 0.7 | 15.3 | 59 |
| 3-19-2012 2:31:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 26 | 78 | 0.6 | 14.8 | 58 |
| 3-19-2012 2:31:59 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 27 | 78 | 0.6 | 14.8 | 58 |
| 3-19-2012 2:32:17 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 25 | 78 | 0.7 | 14.8 | 58 |
| 3-19-2012 2:32:45 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 24 | 78 | 0.7 | 14.8 | 58 |
| 3-19-2012 2:33:05 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 22 | 78 | 0.7 | 14.8 | 58 |
| 3-19-2012 2:33:30 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 23 | 78 | 0.7 | 14.8 | 58 |
| 3-19-2012 2:33:55 PM | RUNNING | 1151 | 1122 | 66 | 92 | 35 | 327690 | 0 | 0 | 79 | 25 | 78 | 0.7 | 14.8 | 58 |

Printed at 3-20-2012 EST

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# Site-Link E-Monitor

Daily Report for

Start
3/22/2012 9:50:00 AM

Stop
3/23/2012 9:20:00 AM

SYSTEM STATUS: **RUNNING**

**Analogs:**

| | VT-LRP |
|---|---|
| MIN: | 16.200000762939 |
| MAX: | 17.8999996 |
| AVERAGE: | 17.3577464 |

**ALARM STATUS**

| Last Alarm | Active |
|---|---|
| KILL-SYS-ALM<br>3/13/2012 2:42:10 PM | NO |

**HOUR METERS:**

| | |
|---|---|
| DP-PS | 2272 |
| VP-LRP | 3043 |
| DP-OWS | 505 |
| AB-STRP | 1406 |
| DP-STRP | 423 |

3/23/2012 9:22:52 AM

Page 1 of 1

# *Project As-Built Document*

27-Aug-13

**RTS151** **WTS, 150gpm, OWS-24, Carbo**

Customer: newterra ltd.

**System Site Specifications**

| | |
|---|---|
| Elevation: | 0 ft |
| Max Temp | 0 deg F |
| Min Temp: | 0 deg F |
| Noise Target: | |
| Gas Required: | |
| Water Required: | |
| Telephone Reqd: | |
| Building: | |

**System Electrical Specifications**

| | |
|---|---|
| Voltage: | 208V/120V-3ph |
| Main Disconnect | 100amp |
| Panel Approval: | MET1604(CL Class CL1DIV2 |
| System Approval: | Class CL1DIV2 |
| Panel Type: | PLC-DL06 |
| Telemetry: | |
| Autodialer: | |
| EMonitor: | Server: |

**System SVE (First Blower)**

0 @ 0

| | |
|---|---|
| Blower Disch Temp: | 0 deg F |
| Inlet Legs: | 0 |
| Disch Press: | 0 in wc |
| Water Flowrate: | 0 gpm |
| Heat xchg Disch: | 0 deg F |

**System SVE (Second Blower)**

0 @ 0

| | |
|---|---|
| Blower Disch Temp: | 0 deg F |
| Inlet Legs: | 0 |
| Disch Press: | 0 in wc |
| Water Flowrate: | 0 gpm |
| Heat xchg Disch: | 0 deg F |

**Air Sparge**

0 @ 0 psi

| | |
|---|---|
| Sparge Disch Temp: | 0 deg F |
| Disch Legs: | 0 |
| Heat xchg Disch: | 0 deg F |

**Other Specifications**

| | |
|---|---|
| Other Inlet Liquid Flow: | 0 gpm |
| Disch Flow: | 150 gpm @ 40 psi |
| AirTreatment: | None |
| Water_Treatment: | Carbon |
| Stripper Airflow: | 0 cfm |
| Stripper Dsn Flow: | 0 gpm |
| OWS_Dsn_Flow: | 150 gpm |

**Contaminants**

**Other Information May be Presented Below**

**Connection Info:**

## *Shipping Information*

## Parts

*Module Code:* 0

| | | |
|---|---|---|
| Insulation, Foil Back Foam, 1", R, Thinsulate, 4x8 | Part: | 10636 |
| | Qty: | 34 |
| | Mfg: | |
| | Mfg Part: | 356075 |
| Lumber, Spruce, Dry, 2" x 4" x 10' | Part: | 10912 |
| 818011 | Qty: | 96 |
| | Mfg: | |
| | Mfg Part: | 818011 |
| Lumber, Plywood, Spr, STD, 4 x 8 x 3/8" | Part: | 14463 |
| 620295 | Qty: | 34 |
| | Mfg: | |
| | Mfg Part: | 620295 |
| Switch, Temperature, Probe, A19ABC-24D | Part: | 15651 |
| range -30/100F | Qty: | 2 |
| | Mfg: | Johnson Controls |
| | Mfg Part: | |
| Breaker, Techna, JTEC4892C40 | Part: | 17700 |
| 240V 40 AMP 2P C Trip Curve | Qty: | 1 |
| 10k SCCR | Mfg. | Fusetek |
| | Mfg Part: | JTEC4892C40 |
| Combination Starter, SQT LUCC32FU | Part: | 19434 |
| TeSysU 1 Phase Control Unit 8-32A | Qty: | 1 |
| 110/120VAC coil | Mfg: | Telemecanique |
| | Mfg Part: | SQT LUCC32FU |
| Wire, Stranded, T90, #1 AWG, Black | Part: | 25152 |
| | Qty: | 10 |
| | Mfg. | |
| | Mfg Part: | T901BLK |

*FLT-6701*

| | | |
|---|---|---|
| Filter, Bag, Dewatering, Assembly, Four (4) | Part: | RC036 |
| | Qty: | 1 |
| | Mfg. | |
| --- | Mfg Part: | --- |

*PI-6701*

| | | |
|---|---|---|
| Gauge, Pressure, 0-60psi, Indumart, P16K2-FG-60 (back) | Part: | 19393 |
| SS, brass internals, Glyc Filled, back mount | Qty: | 8 |
| | Mfg: | |
| --- | Mfg Part: | P16K2-FG-60 |

*PSH-6701*

| | | |
|---|---|---|
| Switch, Pressure, A1F-0-SS-1-2 | Part: | 20589 |
| 4-75 PSI Range | Qty: | 1 |
| Deadband at Min Range 4 - Max Range 15 | Mfg: | Dwyer |
| --- | Mfg Part: | |

## Rental Components

*Module Code:* 2

*RCHOSE DISCH*

| | | |
|---|---|---|
| Hose, Assembly, J300, 3" | Part: | 18661 |
| Green Hose | Qty: | 50 |
| | Mfg: | Maple Leaf Environmental Equipment |
| - | Mfg Part: | - |

*RCHOSE-INLET*

| | | |
|---|---|---|
| Hose, Assembly, J300, 3" | Part: | 18661 |
| Green Hose | Qty: | 50 |
| | Mfg: | Maple Leaf Environmental Equipment |
| - | Mfg Part: | - |

## Submersible Pump

*Module Code:* 4000

*LSH-4001*

| | | |
|---|---|---|
| Switch, Level, Mech Float, Wide Angle, N.O., Red | Part: | M1108 |
| Tilt Float Level Switch 90deg, w 40' cable | Qty: | 1 |
| 13A, SPST, N/O | Mfg: | Warrick Controls |
| --- | Mfg Part: | GR20W4000 |

*P-4001*

| | | |
|---|---|---|
| Pump, Sump, Goulds, 160GPM @ 40' | Part: | RC073 |
| WS2038BHF, 200V, 3 Ph, 2 HP, w/o switch | Qty: | 1 |
| 3" Type F Camlock Fitting | Mfg: | Goulds |
| --- | Mfg Part: | |

## Oil/Water Separator

*Module Code:* 4900

*LSHH-4901*

| | | |
|---|---|---|
| Switch, Level, Mech Float, Narrow Angle, N.C., YEL | Part: | 19279 |
| N/C, Yellow float | Qty: | 1 |
| | Mfg: | |
| --- | Mfg Part: | PY2CW4000 |

*OWS-4901*

| | | |
|---|---|---|
| Media, Coalescing, HD Q-PAC | Part: | 13959 |
| 0.25" spacing, 132 sqft/cuft | Qty: | 24 |
| | Mfg: | |
| --- | Mfg Part: | HD Q-PAC |
| Oil Water Separator, OWS-24, Stainless | Part: | 16263 |
| 24 cubic feet of packing, 304SS | Qty: | 1 |
| Note: Build up price from Price Sheet | Mfg: | Maple Leaf Environmental Equipment |
| To be removed from RTS-148, SVE, WTS returning fron Veron,TX. Purchased used equipment, 50430 Jerry Wood #2 project. | Mfg Part: | |
| Strain Relief, Connector, PVC, 1/2" | Part: | 16884 |
| TSRC10 | Qty: | 2 |
| | Mfg: | |
| None | Mfg Part: | TSRC10 |
| Oil Water Separator, Assembly, OWS-24 | Part: | 17535 |
| | Qty: | 1 |
| | Mfg: | Maple Leaf Environmental Equipment |
| - | Mfg Part: | - |
| Switch, Level, Mech Float, Wide Angle, N.O., Red | Part: | m1108 |
| Tilt Float Level Switch 90deg, w 40' cable | Qty: | 1 |
| 13A, SPST, N/O | Mfg: | Warrick Controls |
| None | Mfg Part: | GR20W4000 |
| Valve, Ball, Brass, 2", 150# | Part: | p1065 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 1 |
| | Mfg: | Kitz |
| None | Mfg Part: | 601-2 |
| Valve, Ball, Brass, 2", 150# | Part: | p1065 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 1 |
| | Mfg: | Kitz |
| None | Mfg Part: | 601-2 |
| Valve, Ball, Brass, 1", 150# | Part: | p1067 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 3 |
| | Mfg: | Kitz |
| None | Mfg Part: | 601-1 |
| Valve, Ball, Brass, 3", 150# | Part: | P1104 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 3 |
| | Mfg: | |
| --- | Mfg Part: | 601-3 |

*P-4901*

| | | |
|---|---|---|
| Valve, Gate, Brass, 3" | Part: | 10167 |
| | Qty: | 1 |
| | Mfg: | |
| None | Mfg Part: | 514T10 |
| Gauge, Pressure, 0-60psi, Indumart, P16T2-FG-60 | Part: | 16203 |
| SS, brass internals, Glyc. Filled, bottom mount | Qty: | 1 |
| | Mfg: | Indumart |
| None | Mfg Part. | |
| Reinforced, Adapter, PVC 80, Female, 3", SxSS | Part: | 17055 |
| Fitting, transition, socket x SS | Qty: | 1 |
| | Mfg: | |
| --- | Mfg Part: | 835-030SR |
| Pump, Piping, Centrifugal, 3" x 3", 170gpm | Part: | 17316 |
| | Qty: | 1 |
| | Mfg: | Maple Leaf Environmental Equipment |
| - | Mfg Part: | - |
| Pump, Suction, Goulds, SSH Series, 4SH2K52C0 | Part: | 21028 |
| 7.5hp, 3ph, 208-230/460V, TEFC | Qty: | 1 |
| C Impeller | Mfg: | Goulds |
| --- | Mfg Part: | --- |
| Hose, Braided, SS, 3", MNPT fittings, 12" long | Part: | 21971 |
| 5680K2 | Qty: | 2 |
| 304SS | Mfg: | |
| None | Mfg Part: | 5680K2 |
| Strainer, Wye, Brass, 3" | Part: | M1523 |
| threaded | Qty: | 1 |
| | Mfg: | |
| None | Mfg Part: | 145T10 |
| Valve, Check, Swing, Brass, 3" | Part: | M1524 |
| | Qty: | 1 |
| | Mfg: | |
| None | Mfg Part: | 521T10 |
| Valve, Check, Swing, Brass, 3" | Part: | M1524 |
| | Qty: | 1 |
| | Mfg: | |
| None | Mfg Part: | 521T10 |
| Union, Galv, 3" | Part: | M1530 |
| | Qty: | 2 |
| | Mfg: | |
| None | Mfg Part: | 3GLU |
| Valve, Ball, Brass, 3", 150# | Part: | P1104 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 1 |
| | Mfg. | |
| - | Mfg Part: | 601-3 |

## Product Storage Tank

*Module Code:* 5200

*LSHH-5201*

| | | |
|---|---|---|
| Switch, Level, Almeg, Vertical, ATB3-48B<br>1/4NPT<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 12351<br>1<br>Almeg<br>ATB3-48B |
| Reducer, Bushing, Galv, 2" x 1/2"<br>Hex<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | P1021<br>1<br><br>2X12GZB |
| Union, Galv, 2"<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | P1093<br>1<br><br>2GZU |

*PST-5201*

| | | |
|---|---|---|
| Tee, Galv, 2"<br>1<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10136<br>1<br><br>2GZT |
| Drum, Black, Steel, 45 gal, 2 hole lid, bottom 2" port<br>including palletization<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | M1137<br>1<br><br>SOH00733 |
| Elbow, 90deg, Galv, 2"<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | P1058<br>4<br><br>2GZE9 |
| Valve, Ball, Brass, 2", 150#<br>NPT, Teflon seats, 600 PSI WOG<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | P1065<br>1<br>Kitz<br>601-2 |
| Nipple, Galv, 2" x Short<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | P1192<br>5<br><br>2xSHGZN |

## Bag Filter

*Module Code:* 5800

*FLT-5801*

| | | |
|---|---|---|
| O-Ring, Buna-N, 8-3/8" OD, 3/16" Thick<br>A70 Hardness<br>* Fits most Filter Innovation EB112 series<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 21619<br>25<br><br>369 BUNA |
| Filter, Bag, Dewatering, Assembly, Four (4)<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | RC033<br>1<br><br>--- |

*FLT-5802*

| | | |
|---|---|---|
| Reducer, Bushing, Galv, 3" x 2"<br>Hex<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10019<br>4<br><br>3X2GZB |
| Tee, Galv, 2"<br>1<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10136<br>2<br><br>2GZT |
| Nipple, Galv, 2" x Close<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10222<br>14<br><br>2XCLGZN |
| Tee, Galv, 3"<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10302<br>2<br><br>3GZT |
| Valve, Ball, Brass, 1/2", 150#<br>NPT, Teflon seats, 600 PSI WOG<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10538<br>2<br><br>601-1/2 |
| Nipple, Galv, 1/2" x Close<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10619<br>2<br><br>12CLGZN |
| Skid, 2ft x 4ft<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 15152<br>1<br>Maple Leaf Environmental Equipment<br> |
| Sample Port Assembly, 1/4"<br><br><br>- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 18682<br>2<br>Maple Leaf Environmental Equipment<br>- |
| Filter, Bag, Housing, #2, Carbon Steel<br>SS Basket, CS legs<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19117<br>2<br><br> |

| | | |
|---|---|---|
| Reducer, Bushing, Galv, 2" x 1/2" | Part: | P1021 |
| Hex | Qty: | 2 |
| | Mfg: | |
| --- | Mfg Part: | 2X12GZB |
| Valve, Ball, Brass, 2", 150# | Part: | P1065 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 4 |
| | Mfg: | Kitz |
| --- | Mfg Part: | 601-2 |
| Union, Galv, 2" | Part: | P1093 |
| | Qty: | 4 |
| | Mfg: | |
| --- | Mfg Part: | 2GZU |

*PI-5801*

| | | |
|---|---|---|
| Gauge, Pressure, 0-60psi, Indumart, P16K2-FG-60 (back) | Part: | 19393 |
| SS, brass internals, Glyc. Filled, back mount | Qty: | 12 |
| | Mfg: | |
| --- | Mfg Part: | P16K2-FG-60 |

*PSH-5801*

| | | |
|---|---|---|
| Switch, Pressure, A1F-0-SS-1-2 | Part: | 20589 |
| 4-75 PSI Range | Qty: | 1 |
| Deadband at Min Range 4 - Max Range 15 | Mfg: | Dwyer |
| --- | Mfg Part: | |

## Bag Filter

*Module Code:* 6700

*FLT-6701*

| | | |
|---|---|---|
| Nipple, Galv, 3" x Close | Part: | 11220 |
| | Qty: | 6 |
| | Mfg: | |
| — | Mfg Part: | 3CLGZN |
| Flange, Companion, Galv, 6" | Part: | 12572 |
| threaded | Qty: | 2 |
| | Mfg: | |
| — | Mfg Part: | 6GZCIF / 12.0905 |
| Valve, Butterfly, Wafer, Ductile Iron, 6" | Part: | 15019 |
| 316SS disc & stem, BUNA, 10 position lever | Qty: | 2 |
| | Mfg: | |
| — | Mfg Part: | CIWB-SBL 6" CO |
| Reducer, Bushing, Galv, 6" x 3" | Part: | 19681 |
| Hex | Qty: | 2 |
| | Mfg: | |
| — | Mfg Part: | |
| Tee, PVC 40, 3", SxSxS, 401-030G | Part: | 22578 |
| | Qty: | 2 |
| | Mfg: | |
| — | Mfg Part: | |
| Elbow, 90deg, PVC 40, 3", SxS, 406-030G | Part: | 22619 |
| | Qty: | 8 |
| | Mfg: | |
| — | Mfg Part: | 406-030G |
| Misc Part, See Details | Part: | 9999 |
| As per detailed specification below | Qty: | 1 |
| | Mfg: | |
| Pricing from Steve Hughes, Aug. 7th,2013 e-mail | Mfg Part: | Qo8L100RB9 |
| V6427-A, Muilti-Bag Filter Housing - 7 Bag Model - 304 Stainless | | |
| Vessel A - Inlet and Outlet are on the right hand side of the unit when looking at the label. | | |
| Misc Part, See Details | Part: | 9999 |
| As per detailed specification below | Qty: | 2 |
| | Mfg: | |
| 4155-1490-B, O-rings for V6427-A Bag Filter Housing | Mfg Part: | Qo8L100RB9 |
| Valve, Ball, Brass, 3", 150# | Part: | P1104 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 1 |
| | Mfg: | |
| — | Mfg Part: | 601-3 |
| Elbow, 90deg, Galv, 3" | Part: | P1220 |
| | Qty: | 1 |
| | Mfg: | |
| — | Mfg Part: | 3GZE9 |

*FT-6701*

| | | |
|---|---|---|
| Reinforced, Adapter, PVC 80, Female, 3", SxSS | Part: | 17055 |
| Fitting, transition, socket x SS | Qty: | 4 |
| | Mfg | |
| --- | Mfg Part: | 835-030SR |

*PSH-6701*

| | | |
|---|---|---|
| Switch, Pressure, A1F-0-SS-1-2 | Part: | 20589 |
| 4-75 PSI Range | Qty: | 1 |
| Deadband at Min Range 4 - Max Range 15 | Mfg: | Dwyer |
| --- | Mfg Part: | |

## Liquid Phase Carbon

*Module Code:* 7000

*7000*

| | | |
|---|---|---|
| Nipple, Galv, 3" x Close | Part: | 11220 |
| | Qty: | 2 |
| | Mfg: | |
| --- | Mfg Part: | 3CLGZN |
| Valve, Ball, Brass, 3", 150# | Part: | P1104 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 1 |
| | Mfg: | |
| --- | Mfg Part: | 601-3 |
| Adapter, PVC 80, Female, 3", SxT, 835-030G | Part: | P1153 |
| | Qty: | 2 |
| | Mfg: | |
| --- | Mfg Part: | 835-030 |

*FQI,FT-7001*

| | | |
|---|---|---|
| Meter, Water, 2", US Gal, w/ pulse, Turbine, DLJ | Part: | 15499 |
| Flange | Qty: | 1 |
| | Mfg: | Daniel L. Jerman Co. |
| --- | Mfg Part: | DLJ200TC |

*LPC-7001*

| | | |
|---|---|---|
| Reducer, Bushing, Galv, 3" x 2" | Part: | 10019 |
| Hex | Qty: | 5 |
| | Mfg: | |
| --- | Mfg Part: | 3X2GZB |
| Tee, Galv, 3" | Part: | 10302 |
| | Qty: | 5 |
| | Mfg: | |
| --- | Mfg Part: | 3GZT |
| Nipple, Galv, 3" x Short (3") | Part: | 10445 |
| | Qty: | 4 |
| | Mfg: | |
| --- | Mfg Part: | 3SHGZN |
| Camlock Fitting, Aluminum, 3", Part "F" | Part: | 10541 |
| Male Adapter x Male Thread Cam Lock Fitting | Qty: | 6 |
| | Mfg: | Bayco Industries |
| - | Mfg Part: | BAL-300F |
| Camlock Fitting, Aluminum, 3", Part "C" | Part: | 10542 |
| Female Adapter x Hose Shank Cam Lock Fitting | Qty: | 6 |
| | Mfg: | Bayco Industries |
| - | Mfg Part: | BAL-300C |
| Hose, Suction, PVC, Green, 3", J300 | Part: | 12043 |
| TigerFlex, 65psi@70F, 40psi@100F | Qty: | 30 |
| PVC,150F, (min 100ft order) | Mfg: | Kuriyama |
| - | Mfg Part: | J300 |
| Reinforced, Adapter, PVC 80, Female, 3", SxSS | Part: | 17055 |
| Fitting, transition, socket x SS | Qty: | 6 |
| | Mfg: | |
| --- | Mfg Part: | 835-030SR |

| | | |
|---|---|---|
| Hose, Assembly, J300, 3" | Part: | 18661 |
| Green Hose | Qty: | 3 |
| | Mfg: | Maple Leaf Environmental Equipment |
| - | Mfg Part: | - |
| Sample Port Assembly, 1/4" | Part: | 18682 |
| | Qty: | 3 |
| | Mfg: | Maple Leaf Environmental Equipment |
| - | Mfg Part: | - |
| Valve, Check, Spring, Brass, 2" | Part: | M1529 |
| | Qty: | 1 |
| | Mfg: | |
| — | Mfg Part: | 2BPUCV |
| Clamp, Hose, SS, 3", HAS48 | Part: | P1044 |
| | Qty: | 12 |
| | Mfg: | |
| None | Mfg Part: | HAS48 |
| Valve, Ball, Brass, 3", 150# | Part: | P1104 |
| NPT, Teflon seats, 600 PSI WOG | Qty: | 4 |
| | Mfg: | |
| — | Mfg Part: | 601-3 |
| Reducer, Bushing, Galv, 2" x 1/4" | Part: | P1219 |
| Hex | Qty: | 5 |
| | Mfg: | |
| — | Mfg Part: | 2x14GZB |

*PI-7001*

| | | |
|---|---|---|
| Gauge, Pressure, 0-60psi, Indumart, P16T2-FG-60 | Part: | 16203 |
| SS, brass internals, Glyc. Filled, bottom mount | Qty: | 2 |
| | Mfg: | Indumart |
| — | Mfg Part: | |

*PI-7004*

| | | |
|---|---|---|
| Gauge, Pressure, 0-60psi, Indumart, P16K2-FG-60 (back) | Part: | 19393 |
| SS, brass internals, Glyc. Filled, back mount | Qty: | 1 |
| | Mfg: | |
| — | Mfg Part: | P16K2-FG-60 |

*PSH-7001*

| | | |
|---|---|---|
| Switch, Pressure, A1F-0-SS-1-2 | Part: | 20589 |
| 4-75 PSI Range | Qty: | 1 |
| Deadband at Min Range 4 - Max Range 15 | Mfg: | Dwyer |
| — | Mfg Part: | |

## Building, Trailer or Skid

*Module Code:* 7900

*7900*

| | | |
|---|---|---|
| Door, Single, 36", Steel slab/no brick moulding, No sill ext<br>1103A,wooden frame,open out,RH<br>**to be pre drilled for passage and deadbolt**<br>- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10822<br>1<br><br>1103-Dalmen |
| Lock, Passage, 107188, Taymor<br>107188<br><br>None | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10908<br>1<br><br> |
| Lock, Deadbolt, 289648, Taymor, 1 cyl, S/S<br>keyed alike #289648<br><br>None | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10909<br>1<br><br> |
| Container, Painting, 40ft exterior/interior<br><br><br>Building exterior, to be painted our standard white finish. | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 12063<br>1<br><br> |
| Container, Shipping, Tilt load<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 13593<br>1<br><br> |
| Container, 8' x 40' x High Cube<br><br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 15512<br>1<br><br> |
| Container, Modification<br>As per specification below or drawing provided.<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 15513<br>1<br><br> |
| Door, Assembly, 72", Double<br><br><br>- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19012<br>1<br>Maple Leaf Environmental Equipment<br>- |
| Door, Assembly, 36", Single<br><br><br>- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19014<br>1<br>Maple Leaf Environmental Equipment<br>- |

*Access Cover*

| | | |
|---|---|---|
| Misc Part, See Details<br>As per detailed specification below<br><br>As per attached drawing. For 36"x36" Carbon Access Cover | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 9999<br>3<br><br>--- |

*F-7901*

| | | |
|---|---|---|
| Fan, Building, 24", 1/3hp, 1625rpm, 120/230V, 1ph, XPF<br>SD24-XPF, OSHA Guard,Turnout Box<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 10329<br>1<br>Canarm<br>SD24-XPF-OSHA |

| | | |
|---|---|---|
| Fan Shutter Assembly,KD,24",KDS24-SS - Use 23082 | Part: | 10330 |
| | Qty: | 1 |
| | Mfg: | Canarm |
| --- | Mfg Part: | KD24-SS |
| Fan, Hood, White,24",HFPW-24 | Part: | M1411 |
| | Qty: | 2 |
| | Mfg: | Canarm |
| --- | Mfg Part: | HFPW-24 |

*F-7903*

| | | |
|---|---|---|
| Fan, Shutter, Backdraft damper, 12"x12" | Part: | 23080 |
| Non-Motorized | Qty: | 1 |
| | Mfg: | Canarm |
| --- | Mfg Part: | SR3212X12 |
| Hood, 15" | Part: | 23989 |
| Fits 12" Fan & Louver | Qty: | 2 |
| | Mfg: | |
| --- | Mfg Part: | |
| Fan, Building, 12", 1/4hp, 1750rpm, 120V, 1ph, TEFC | Part: | M1072 |
| CSA Approved, S12-E1 | Qty: | 1 |
| | Mfg: | Canarm |
| --- | Mfg Part: | SD120311 |

*H-7901*

| | | |
|---|---|---|
| Switch, Temperature, Johnson Controls, Assembly | Part: | 18985 |
| | Qty: | 2 |
| | Mfg: | Johnson Controls |
| - | Mfg Part: | - |

*H-7903*

| | | |
|---|---|---|
| Heater, Baseboard, Ouellet, 1.5kW, OFM1508 | Part: | 22314 |
| 208V, 66" long | Qty: | 1 |
| | Mfg: | Ouellet |
| --- | Mfg Part: | OFM1508 |

*TSH-7903*

| | | |
|---|---|---|
| Switch, Temperature, Probe, A19ABC-24D | Part: | 15651 |
| range -30/100F | Qty: | 1 |
| | Mfg: | Johnson Controls |
| -30 - 100 F option | Mfg Part: | |
| Switch, Temperature, Probe, WEL 14A-602R | Part: | 15653 |
| Bulb, Well for Temperature Switch, Brass | Qty: | 1 |
| | Mfg: | Johnson Controls |
| -30 - 100 F option | Mfg Part: | WEL 14A-602R |
| Switch, Temperature, Johnson Controls, Assembly | Part: | 18985 |
| | Qty: | 1 |
| | Mfg: | Johnson Controls |
| - | Mfg Part: | - |

*TSL-7903*

| | | |
|---|---|---|
| Switch, Temperature, Probe, A19ABC-24D | Part: | 15651 |
| range -30/100F | Qty: | 1 |
| | Mfg: | Johnson Controls |
| -30 - 100 F option | Mfg Part: | |

| | | |
|---|---|---|
| Switch, Temperature, Probe, WEL 14A-602R | Part: | 15653 |
| Bulb, Well for Temperature Switch, Brass | Qty: | 1 |
| | Mfg: | Johnson Controls |
| -30 - 100 F option | Mfg Part: | WEL 14A-602R |
| Switch, Temperature, Johnson Controls, Assembly | Part: | 18985 |
| | Qty: | 1 |
| | Mfg: | Johnson Controls |
| - | Mfg Part: | - |

## Main Control Panel

*Module Code:* 8200

*8200*

| | | |
|---|---|---|
| Contactor, SQD LC1D32G7 | Part: | 10520 |
| 32A, 10/10/20/25HP | Qty: | 1 |
| 120VAC coil | Mfg: | Square D |
| --- | Mfg Part: | SQD LC1D32G7 |
| Disconnect, 3ph, D324N | Part: | 11163 |
| 200A, UL.240V,Nema 1,fusible disconnect | Qty: | 1 |
| | Mfg: | Square D |
| --- | Mfg Part: | SQD D324N |
| Contactor, SQD LC1D09G7 | Part: | 12547 |
| 9A, 2/2/5/7.5HP | Qty: | 1 |
| 120VAC coil | Mfg: | Square D |
| --- | Mfg Part: | SQD LC1D09G7 |
| Contactor, SQD LC1D50AG7 | Part | 12548 |
| 50A, 15/15/40/40HP | Qty: | 1 |
| 120VAC coil | Mfg | Square D |
| --- | Mfg Part: | SQD LC1D50G7 |
| Modem, Antenna, Airlink GPRS, N-Female | Part | 13723 |
| 120-110-2107 | Qty. | 1 |
| MAX-BMLPVDB800/1900 Antenna & MAX-MTPM-800 Hardwar | Mfg. | |
| --- | Mfg Part: | 120-110-2107 |
| PLC, EA1-S3ML | Part: | 17233 |
| C-more micro graphic user interface | Qty: | 1 |
| | Mfg: | Automation Direct |
| --- | Mfg Part: | EA1-S3ML |
| PLC, DV-1000CBL | Part: | 17234 |
| 2m Cable RJ12 to RJ12 | Qty: | 1 |
| C-more Micro to DL05/06/205 | Mfg: | Automation Direct |
| --- | Mfg Part: | DV-1000CBL |
| Breaker, Techna, JTEC4892C30 | Part: | 17543 |
| 480/277V 30 AMP 2P C Trip Curve | Qty: | 1 |
| 10k SCCR | Mfg: | Fusetek |
| --- | Mfg Part: | JTEC4892C30 |
| Breaker, Techna, JTEC4893C06 | Part: | 17709 |
| 480/277V 6 AMP 3P C Trip Curve | Qty: | 1 |
| 10k SCCR | Mfg: | Fusetek |
| --- | Mfg Part: | JTEC4893C06 |
| Breaker, Techna, JTEC4893C40 | Part | 17717 |
| 240V 40 AMP 3P C Trip Cuve | Qty | 2 |
| 10k SCCR | Mfg: | Fusetek |
| --- | Mfg Part: | JTEC4893C40 |
| Breaker, Techna, JTEC4893C50 | Part: | 17718 |
| 240V 50 AMP 3P C Trip Curve | Qty: | 1 |
| 10k SCCR | Mfg: | Fusetek |
| --- | Mfg Part: | JTEC4893C50 |

| | | |
|---|---|---|
| Breaker, Techna, JTEC4891C15<br>240V 15A, 1P C Trip Curve<br>10k SCCR<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 18359<br>1<br>Fusetek<br>JTEC4891C15 |
| Motor Saver, 460 w/Diagnostic 3ph<br>Finger Safe, DIN Rail Mountable<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 18396<br>1<br>Symcom<br>460 |
| Combination Starter, SQT LUB12<br>TeSysU Power Base 12A<br>3HP@208/240, 7.5HP@480, 10HP@600<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19264<br>1<br>Telemecanique<br>SQT LUB12 |
| Combination Starter, SQT LUA1C20<br>TeSysU Aux Contact Module<br>1NO Ready 1NO Fault<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19269<br>2<br>Telemecanique<br>LUA1C20 |
| Combination Starter, SQT LU9SP0<br>TeSysU UL508 Type E Phase Barrier<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19270<br>2<br>Telemecanique<br>SQT LU9SP0 |
| Combination Starter, SQT LUB32<br>TeSysU Power Base 32A<br>10HP@208/240, 20HP@480, 25HP@600<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19273<br>1<br>Telemecanique<br>SQT LUB 32 |
| Combination Starter, SQT LUCA32FU<br>TeSysU Standard Control Unit 8-32A<br>110/120VAC coil<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19274<br>1<br>Telemecanique<br>SQT LUCA32FU |
| Combination Starter, SQT LUCC12FU<br>TeSysU 1 Phase Control Unit 3-12<br>110/120VAC coil<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19456<br>1<br>Telemecanique<br>LUCC12FU |
| Transformer, Hammond, HAT Q005YEKF<br>208V to 240V,5KVA,UL/CSA,3R 1ph<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 19999<br>1<br>Hammond Power Solutions<br>HAT Q005BECF |
| Modem, Cable, RF, N-Male to SMA-Male, 15' Length<br>GW195-180-SM-NM<br>Use with Raven XE<br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 20569<br>1<br><br>GW195-180-SM-N |
| Relay, SQT RXM4AB1F7<br>Miniature Relay 4PDT 120 V AC<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 21887<br>1<br>Telemecanique<br>SQT RXM4AB1F |
| Relay, SQT RXM4AB1BD<br>Miniature Relay 4PDT 24 V DC<br><br>--- | Part:<br>Qty:<br>Mfg:<br>Mfg Part: | 21888<br>1<br>Telemecanique<br>SQT RXM4AB1B |

| | | |
|---|---|---|
| Relay, SQT RXZE2S114M | Part: | 21889 |
| Base/Socket for RXM4 4P Relays | Qty: | 1 |
| | Mfg: | Telemecanique |
| --- | Mfg Part: | SQT RXZE2S114 |
| Relay, SQT RXZE2S114M | Part: | 21889 |
| Base/Socket for RXM4 4P Relays | Qty: | 1 |
| | Mfg: | Telemecanique |
| --- | Mfg Part: | SQT RXZE2S114 |
| Relay, SQT RXZE2S114M | Part: | 21889 |
| Base/Socket for RXM4 4P Relays | Qty: | 1 |
| | Mfg: | Telemecanique |
| --- | Mfg Part: | SQT RXZE2S114 |
| Modem, Bracket, Mounting, Airlink Raven XE | Part: | 22143 |
| 100-170-1015 | Qty: | 1 |
| Use with Raven XE | Mfg: | |
| --- | Mfg Part: | 100-170-1015 |
| Modem, Airlink Raven, XE V2228E-SA w/AC Pwr Adapter, Sprint | Part: | 22170 |
| V2228E-SA | Qty: | 1 |
| Requires mounting bracket MLE# 22143 | Mfg: | Airlink_Communications |
| --- | Mfg Part: | V2221E-SA |
| Fuse, GLD GDL3 | Part: | E1187 |
| 3A 250V Time Delay | Qty: | 1 |
| Miniature 1/4"x1-1/4" | Mfg: | Ferraz Shawmut |
| --- | Mfg Part: | GLD GDL3 |
| Fuse, GLD TR125R | Part: | E1206 |
| 125A 240V Time Delay | Qty: | 3 |
| Class R | Mfg: | Ferraz Shawmut |
| --- | Mfg Part: | GLD TR125R |

*Panel*

| | | |
|---|---|---|
| Misc Part, See Details | Part: | 9999 |
| As per detailed specification below | Qty: | 1 |
| | Mfg. | |
| Use and modify the old RTS070 PLC Control panel and Disconnect in the rental tent. | Mfg Part: | --- |

# Bill of Material

Project RTS151
Description Baffinland Iron Mines Corp^Mary River Project/ PM
Ordernumber 102140
Drawing Number

1325 CALIFORNIA AVE.
BROCKVILLE. ONTARIO
CANADA
K6V 5Y6

## Installation

| No. | Device Id | Function Text | Quantity | Partnumber | Description | Technical Des | Manufacturer |
|---|---|---|---|---|---|---|---|
| 1 | CB227 | | 1 | 17717 | Breaker, Techna, JTE | Breaker, Techna, JTEC4893C40 , 240V 40 AMP 3P C Trip Cuve | |
| 2 | CB232 | | 1 | 17397 | Breaker, Techna, JTE | Breaker, Techna, JTEC4892C15 , 480/277V 15 AMP 2P C Trip Curve | |
| 3 | CB247 | | 1 | 17717 | Breaker, Techna, JTE | Breaker, Techna, JTEC4893C40 , 240V 40 AMP 3P C Trip Cuve | |
| 4 | CB253 | | 1 | 17698 | Breaker, Techna, JTE | Breaker, Techna, JTEC4892C20 , 480/277V 20 AMP 2P C Trip Curve | |
| 5 | CB261 | | 1 | 17397 | Breaker, Techna, JTE | Breaker, Techna, JTEC4892C15 , 480/277V 15 AMP 2P C Trip Curve | |
| 6 | CB266 | | 1 | 18359 | Breaker, Techna, JTE | Breaker, Techna, JTEC4891C15 , 240V 15A, 1P C Trip Curve | Fusetek |
| 7 | CB271 | | 1 | 17701 | Breaker, Techna, JTE | Breaker, Techna, JTEC4892C50 , 240V 50 AMP 2P C Trip Curve | |
| 8 | CB304 | | 1 | 18359 | Breaker, Techna, JTE | Breaker, Techna, JTEC4891C15 , 240V 15A, 1P C Trip Curve | Fusetek |
| 9 | CB337 | | 1 | 18359 | Breaker, Techna, JTE | Breaker, Techna, JTEC4891C15 , 240V 15A, 1P C Trip Curve | Fusetek |
| 10 | CB346 | | 1 | 18359 | Breaker, Techna, JTE | Breaker, Techna, JTEC4891C15 , 240V 15A, 1P C Trip Curve | Fusetek |
| 11 | CR318 | ESTOP | 1 | 21887 | Relay, SQT RXM4AB1F7 | Relay, SQT RXM4AB1F7 , Miniature Relay 4PDT 120 V AC | Telemechanique |
| 12 | CR318 | ESTOP | 1 | 21889 | Relay, SQT RXZE2S114 | Relay, SQT RXZE2S114M , Base/Socket for RXM4 4P Relays | Telemechanique |
| 13 | CR415 | KILL-7901 | 1 | 21888 | Relay, SQT RXM4AB1BD | Relay, SQT RXM4AB1BD , Miniature Relay 4PDT 24 V DC | Telemechanique |
| 14 | CR415 | KILL-7901 | 1 | 21889 | Relay, SQT RXZE2S114 | Relay, SQT RXZE2S114M , Base/Socket for RXM4 4P Relays | Telemechanique |
| 15 | CR750 | SYS-ON | 1 | 21887 | Relay, SQT RXM4AB1F7 | Relay, SQT RXM4AB1F7 , Miniature Relay 4PDT 120 V AC | Telemechanique |
| 16 | CR750 | SYS-ON | 1 | 21889 | Relay, SQT RXZE2S114 | Relay, SQT RXZE2S114M , Base/Socket for RXM4 4P Relays | Telemechanique |
| 17 | CR760 | SYS-PNL | 1 | 21887 | Relay, SQT RXM4AB1F7 | Relay, SQT RXM4AB1F7 , Miniature Relay 4PDT 120 V AC | Telemechanique |
| 18 | CR760 | SYS-PNL | 1 | 21889 | Relay, SQT RXZE2S114 | Relay, SQT RXZE2S114M , Base/Socket for RXM4 4P Relays | Telemechanique |
| 19 | DS201 | 200 AMP | 1 | 11163 | Disconnect, 3ph, D32 | Disconnect, 3ph, D324N , 200A, UL,240V,Nema 1,fusible disconnect | SQD |
| 20 | DS201 | 200 AMP | 1 | E1206 | Fuse, GLD TR125R | Fuse, GLD TR125R , 125A 240V Time Delay | Gould |
| 21 | DS201 | 200 AMP | 1 | E1206 | Fuse, GLD TR125R | Fuse, GLD TR125R , 125A 240V Time Delay | Gould |

## Installation

| No | Device Id | Function Text | Quantity | Partnumber | Description | Technical Des | Manufacturer |
|---|---|---|---|---|---|---|---|
| 22 | DS201 | 200 AMP | 1 | E1206 | Fuse, GLD TR125R | Fuse, GLD TR125R , 125A 240V Time Delay | Gould |
| 23 | FU303 | | 1 | E1187 | Fuse, GLD GDL3 | Fuse, GLD GDL3 , 3A 250V Time Delay | Gould |
| 24 | FU303 | | 1 | 19077 | Fuse, Holder, PHX 30 | Fuse, Holder, PHX 3004171 , 1P 10A 250V | Phoenix |
| 25 | FU304 | | 1 | E1186 | Fuse, GLD GDL2 | Fuse, GLD GDL2 , 2A 250V Time Delay | Gould |
| 26 | FU304 | | 1 | 19077 | Fuse, Holder, PHX 30 | Fuse, Holder, PHX 3004171 , 1P 10A 250V | Phoenix |
| 27 | FU318 | | 1 | E1188 | Fuse, GLD GDL5 | Fuse, GLD GDL5 , 5A 250V Time Delay | Gould |
| 28 | FU318 | | 1 | 19077 | Fuse, Holder, PHX 30 | Fuse, Holder, PHX 3004171 , 1P 10A 250V | Phoenix |
| 29 | FU323 | | 1 | E1188 | Fuse, GLD GDL5 | Fuse, GLD GDL5 , 5A 250V Time Delay | Gould |
| 30 | FU323 | | 1 | 19077 | Fuse, Holder, PHX 30 | Fuse, Holder, PHX 3004171 , 1P 10A 250V | Phoenix |
| 31 | FU546 | | 1 | E1190 | Fuse, GLD GGC1 | Fuse, GLD GGC1 , 1A 250V Fast Acting | Gould |
| 32 | FU546 | | 1 | 19077 | Fuse, Holder, PHX 30 | Fuse, Holder, PHX 3004171 , 1P 10A 250V | Phoenix |
| 33 | IS402 | | 1 | 12475 | Barriers, IS, D1031Q | Barriers, IS, D1031Q , Must be marked with UL Approval | GMI |
| 34 | IS411 | | 1 | 12475 | Barriers, IS, D1031Q | Barriers, IS, D1031Q , Must be marked with UL Approval | GMI |
| 35 | IS424 | | 1 | 12475 | Barriers, IS, D1031Q | Barriers, IS, D1031Q , Must be marked with UL Approval | GMI |
| 36 | KILL318 | | 1 | 14607 | Button, E-Stop, ZB5 | Button, E-Stop, ZB5 AT4 , E-Stop Button | SQD |
| 37 | KILL318 | | 1 | 14607 | Button, E-Stop, ZB5 | Button, E-Stop, ZB5 AT4 , E-Stop Button | SQD |
| 38 | KILL318 | | 1 | 14609 | Button, ZB5 AZ105 | Collar with 1-N/0 and 1-N/C Contact Block | SQD |
| 39 | KILL318 | | 1 | 14609 | Button, ZB5 AZ105 | Collar with 1-N/0 and 1-N/C Contact Block | SQD |
| 40 | KILL318 | | 1 | 23054 | Label, Emergency Sto | Label, Emergency Stop, SQT ZBY9330 , | |
| 41 | KILL318 | | 1 | 23054 | Label, Emergency Sto | Label, Emergency Stop, SQT ZBY9330 , | |
| 42 | LT608 | P-4001 | 1 | 18625 | Button, XB7EV03GP | Button, XB7EV03GP , Green LED Pilot Light 120VAC | Square D |
| 43 | LT614 | P-4901 | 1 | 18625 | Button, XB7EV03GP | Button, XB7EV03GP , Green LED Pilot Light 120VAC | Square D |
| 44 | LT755 | SYSTEM | 1 | 18626 | Button, XB7EV04GP | Button, XB7EV04GP , Red LED Pilot Light 120VAC | Square D |
| 45 | M227 | H-7902 | 1 | 10520 | Contactor, SQD LC1D3 | Contactor, SQD LC1D32G7 , 32A, 10/10/20/25HP | SQD |
| 46 | M247 | H-7901 | 1 | 10520 | Contactor, SQD LC1D3 | Contactor, SQD LC1D32G7 , 32A, 10/10/20/25HP | SQD |
| 47 | OP367 | MICRO-GRAPHIC | 1 | 17233 | PLC, EA1-S3ML | PLC, EA1-S3ML , C-more micro graphic user interface | |
| 48 | OP367 | MICRO-GRAPHIC | 1 | 17234 | PLC, DV-1000CBL | PLC, DV-1000CBL , 2m Cable RJ12 to RJ12 | |
| 49 | PDB206 | | 1 | E1217 | Power Block, GLD 675 | Power Block, GLD 67583 , 175A 1Pri 8Sec Aluminum | Gould |
| 50 | PDB206 | | 1 | 16071 | Power Block, GLD 857 | Power Block, GLD 8570 , safety cover | Gould |
| 51 | PDB206 | | 1 | 16071 | Power Block, GLD 857 | Power Block, GLD 8570 , safety cover | Gould |
| 52 | PDB206 | | 1 | 16071 | Power Block, GLD 857 | Power Block, GLD 8570 , safety cover | Gould |
| 53 | PDB206A | | 1 | E1215 | Power Block, GLD 631 | Power Block, GLD 63163 , 90A 1Pri 4Sec Aluminum 3P | Gould |

## Installation

| No. | Device Id | Function Text | Quantity | Partnumber | Description | Technical Des | Manufacturer |
|---|---|---|---|---|---|---|---|
| 54 | PDB206A | | 1 | 16010 | Power Block, GLD 853 | Power Block, GLD 8530 , safety cover | Gould |
| 55 | PDB206A | | 1 | 16010 | Power Block, GLD 853 | Power Block, GLD 8530 , safety cover | Gould |
| 56 | PDB206A | | 1 | 16010 | Power Block, GLD 853 | Power Block, GLD 8530 , safety cover | Gould |
| 57 | PLC369 | | 1 | DLO6 | | | |
| 58 | PLC507 | | 1 | 12752 | PLC, D0-06DR-D | PLC, D0-06DR-D , 20PT 24VDC Input 16PT Relay Output Base Unit DL06 | Koyo |
| 59 | PLC507 | | 1 | E1024 | PLC, D2-Bat-1 | PLC, D2-Bat-1 , Battery for PLC DL05/06/205 | |
| 60 | PLC508 | | 1 | D0-06DR-D | | | |
| 61 | PS304 | | 1 | 20780 | Power supply, Teleme | Power supply, Telemecanique ABL7 RM24025 , In 100-240VAC Out 24VDC 2.5A | Telemechanique |
| 62 | PWR203 | | 1 | 18396 | Motor Saver, 460 w/D | Motor Saver, 460 w/Diagnostic 3ph , Finger Safe, DIN Rail Mountable | |
| 63 | REC337 | | 1 | GFI-15 | | | |
| 64 | STR216 | P-4001 | 1 | 19274 | Combination Starter, | Combination Starter, SQT LUCA32FU , TeSysU Standard Control Unit 8-32A | |
| 65 | STR216 | P-4001 | 1 | 19273 | Combination Starter, | Combination Starter, SQT LUB32 , TeSysU Power Base 32A | |
| 66 | STR216 | P-4001 | 1 | 19269 | Combination Starter, | Combination Starter, SQT LUA1C20 , TeSysU Aux Contact Module | Telemechanique |
| 67 | STR216 | P-4001 | 1 | 19270 | Combination Starter, | Combination Starter, SQT LU9SP0 , TeSysU UL508 Type E Phase Barrier | |
| 68 | STR272 | P-4901 | 1 | 20669 | Combination Starter, | Combination Starter, SQT LUCC18FU , TeSysU 1 Phase Control Unit 4.5-18 | |
| 69 | STR272 | P-4901 | 1 | 19273 | Combination Starter, | Combination Starter, SQT LUB32 , TeSysU Power Base 32A | |
| 70 | STR272 | P-4901 | 1 | 19269 | Combination Starter, | Combination Starter, SQT LUA1C20 , TeSysU Aux Contact Module | Telemechanique |
| 71 | STR272 | P-4901 | 1 | 19270 | Combination Starter, | Combination Starter, SQT LU9SP0 , TeSysU UL508 Type E Phase Barrier | |
| 72 | SW609 | | 1 | 14660 | Button, ZB5 AD3 | Button, ZB5 AD3 , 3 Pos. Switch, Maintained | SQD |
| 73 | SW609 | | 1 | 14610 | Button, ZB5 AZ103 | Button, ZB5 AZ103 , 3 | SQD |
| 74 | SW615 | | 1 | 14660 | Button, ZB5 AD3 | Button, ZB5 AD3 , 3 Pos. Switch, Maintained | SQD |
| 75 | SW615 | | 1 | 14610 | Button, ZB5 AZ103 | Button, ZB5 AZ103 , 3 | SQD |
| 76 | T249 | | 1 | 19999 | Transformer, Hammond | Transformer, Hammond, HAT Q005YEKF , 208V to 240V,5KVA,UL/CSA,3R,1ph | |

# Mercoid® Series A1F Compact OEM Pressure Switch

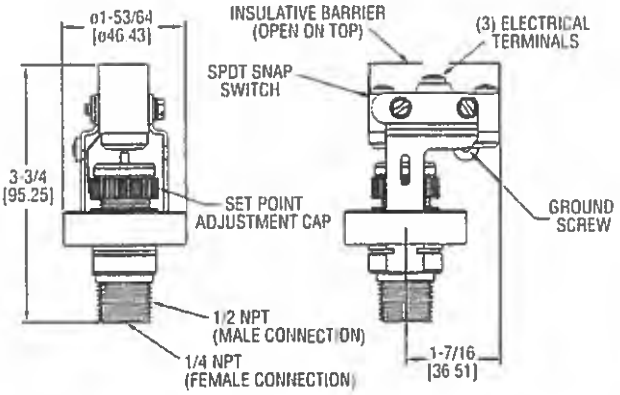
## Specifications - Installation and Operating Instructions

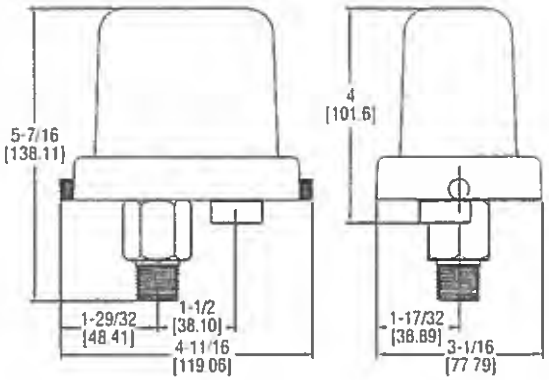
A1F



A1F with A-447






**The Series A1F Compact OEM Pressure Switch** is ideal for panel mounting wherever a high-quality, economical open-case or weatherproof control is required.

### INSTALLATION

**1. Location:** Select a location where the temperature limits of -40 to 180°F (-40 to 82°C) will not be exceeded. Locate the switch as close as possible to the pressure source. Long lengths of piping will not affect accuracy of the actuation point but will slightly add to response time.

**2. Mounting and Processing Connection:** Avoid mounting surfaces with excess vibration which could cause false actuation when pressure is near setpoint. The switch should be mounted within 20° of vertical for proper operation. Mount the switch by connecting it to the process piping using either 1/4" NPT female or 1/2" male connection. Pipe joint compound or TFE thread tape should be used to prevent leakage.

**3. Electrical Connections:** The SPDT snap switch includes normally open, normally closed and common connections. The common and normally open contacts will close and the common and normally closed contacts will open when pressure increases to the setpoint. The actions will reverse when pressure decreases below the setpoint minus the deadband. A green grounding screw is provided on the switch bracket. All wiring should be in accordance with local codes.

### SETPOINT ADJUSTMENT

1. Determine the setpoint pressure. The approximate actuation point can be set by turning the adjustment cap up or down, aligning the top of the O-ring, located above the cap, with the appropriate scale graduation.
2. Connect tubing or piping from the pressure port on bottom of switch to one leg of a tee. Connect the second leg to a pressure test gage of known accuracy and in an appropriate range. The third leg should be connected to a controllable source of pressure.
3. Connect a volt/ohm meter or other circuit tester to the snap action terminals to indicate when switching occurs.
4. Slowly apply pressure to the system and note the pressure at which switching occurs.
5. Operate the switch through several cycles to confirm proper actuation point.
6. Remove test apparatus and attach switch to pressure source and control circuit wiring. Place switch in service.

### SPECIFICATIONS

**Service:** Compatible liquids and gases.
**Wetted Materials:**
**Pressure Chamber:** 316 SS.
**Diaphragm:** Fluorocarbon.
**Temperature Limit:** -40 to 175°F (-40 to 80°C).
**Pressure Limits:** 750 psig (51 bar).
**Enclosure Rating:** No rating for open construction. Installed properly within an optional A-447 enclosure meets NEMA 4X standards.
**Switch Type:** SPDT snap switch.
**Electrical Rating:** 15A @ 120/240/480 VAC, 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC.
**Electrical Connection:** Screw terminals.
**Process Connection:** 1/4" female NPT and 1/2" male NPT.
**Mounting Orientation:** Within 20° of vertical.
**Set Point Adjustment:** Knurled screw cap with indicating scale.
**Deadband:** Fixed, See deadband chart.
**Weight:** 10.5 oz (297 g).

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**Example of how to order:**

A1F - O - SS - 1 - 4
1 2 3 4 5

1. Diaphragm Designation:
   F - Fluorocarbon
2. Enclosure Designation:
   O - Open Construction No Enclosure
3. Housing Material Designation:
   SS - 316SS
4. Switch Designation:
   1 - SPDT Snap Action Switch
5. Operating Pressure Range Designation:
   1 - 2 to 15 psig
   2 - 4 to 75 psig
   3 - 8 to 225 psig
   4 - 16 to 450 psig

**Series A1F Deadband Chart-psig (bar)**

| Range | Deadband at Minimum Range | Deadband at Maximum Range |
|---|---|---|
| 2 to 15 (0.14 to 1.03) | 2 (0.14) | 3 (0.21) |
| 4 to 75 (0.28 to 5.17) | 4 (0.27) | 15 (1.0) |
| 8 to 225 (0.55 to 15.5) | 8 (0.55) | 25 (1.7) |
| 16 to 450 (1.1 to 31.0) | 15 (1.0) | 50 (3.5) |

## MAINTENANCE

Upon final installation of the Series A1F Compact OEM Pressure Switch, no routine maintenance is required. A periodic check of the system calibration is recommended. The Series A1F is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

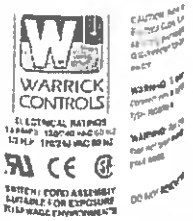
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# Series M
# Mechanical Tilt Float Level Switch



- Non-Mercury Switch
- Sealed Cable
- Impact & Corrosion Resistant ABS Shell
- N.O., N.C., SPDT Contacts
- Various Cable Lengths
- Color Coded Body




Designed for level control and alarm applications in difficult liquids such as sewage and waste water. Series M mechanical tilt floats are ideal for applications where the presence of mercury is a concern. Series M Switches have impact resistant ABS shell and neoprene jacketed cable.

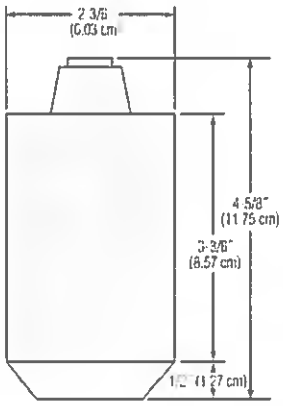
## Specifications

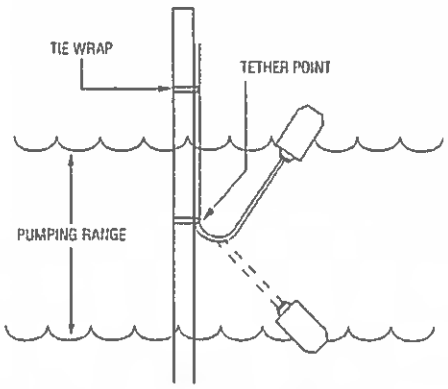
| | |
|---|---|
| **Cord** | 2 or 3 conductor 16 AWG wire SJOW Oil Resistant CPE |
| **Contact Rating** | 13 amp @ 120/240 VAC 1/2 hp |
| **Contact Design** | SPST, Normally Open or Normally Closed<br>Common with N.O. & N.C. (form C) |
| **Temperature Rating** | |
| **Dry** | 32°F to 194°F (0°C to 90°C) |
| **Water Resistant** | 32°F to 140°F (0°C to 60°C) |
| **Overall Weight** | 1.0 lbs. (not including weight) |
| **Tether Method** | Tie-wrap nylon, weight: 2.5 lbs. |
| **Approvals** | U.L. Recognized, CSA Cert. |

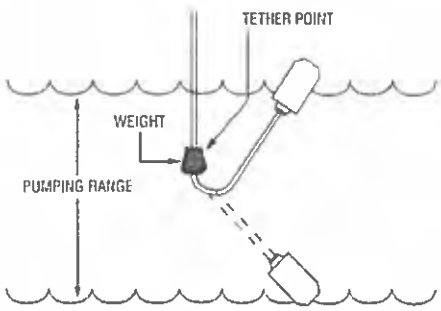
## Applications

- Level Control
- Alarms
- Sewage Lift Systems
- Slurries
- Drainage Sumps
- Wastewater Treatment
- Holding Tanks

## Dimensions




## How to Order

Use the **Bold** characters from the chart below to construct a product code.

**M XXX XX X**

**Series**
**M**

**Contact Configuration**
**BLU** – SPST, Normally Open, narrow angle[1]
**YEL** – SPST, Normally Closed, narrow angle[1]
**RED** – SPST, Normally Open, wide angle[2]
**WHI** – SPST, Normally Closed, wide angle[2]
**GRE** – SPDT, Form C, wide angle[2]

**Length**
**40** – 40 feet (12.19 m)

**Tether Method**
**T** – Tie
**W** – Weight

| Tether Method | Part Number |
|---|---|
| Tie Wrap | 7762360 |
| Weight | 7762381 |

Notes
1 Narrow angle pumping range approximately 2 in. to 8 in
2 Wide angle pumping range approximately 5 in. to 18 in

newterra
smart technology sustainable solutions.

# OIL WATER SEPARATORS – OWS SERIES

**Application:**

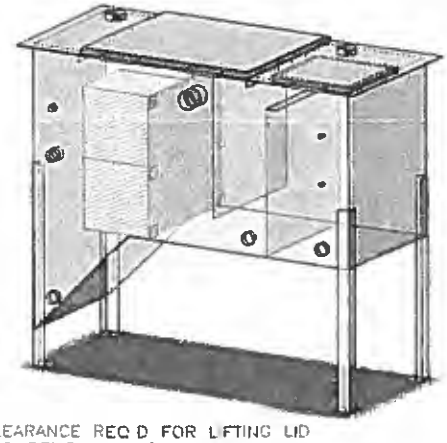
**newterra** Oil Water Separators are designed to remove oil from a liquid phase inlet stream. As the oil/water mixture is passed through the coalescing oil/water separator, larger oil droplets migrate to the surface to be collected and skimmed off. The media collects the smaller droplets until they are large and buoyant enough to float to the surface.

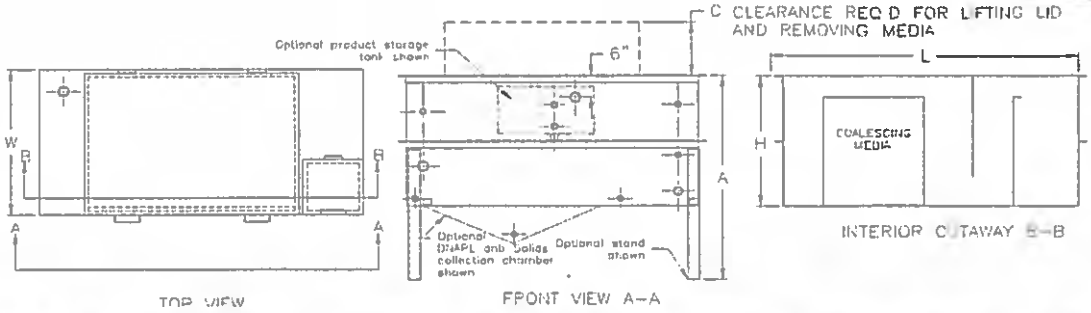
**Construction:**

The standard OWS Series are fabricated from carbon steel. For corrosion resistance, the interior is epoxy coated and the exterior is painted. Optional stainless steel construction is also available. A large lid allows access to the coalescing media and oil skimmer while a small lid allows access to the pump-out tank.

**Standard Features:**

- Standard finish: Interior is epoxy coated. Exterior is painted **newterra** blue over zinc primer (except stainless steel option)
- Sacrificial anode to prevent corrosion of tank.
- 11 AWG carbon steel construction
- Sludge containment section
- Adjustable oil skimmer
- Water underflow/overflow weir design
- Easy removal of coalescing media for cleaning
- High Alarm Level Coupling and Pump High/Low Level Coupling in the pump-out chamber






**Dimension Chart:**

| Part Number | Width "W" | Standard Height "H" | Standard Overall Length | Length with Extended Pump-out | Height with Elevated Pump-out "A" | Overhead Clearance "C" | Standard Pump-out Volume | Extended Pump-out Volume | Elevated Pump-out Volume | Product Tank Volume |
|---|---|---|---|---|---|---|---|---|---|---|
| OWS-2 | 16" | 30" | 64" | 76" | n/a | 14" | 23 Gal | 41 Gal | n/a | 8.1 Gal |
| OWS-4 | 28" | 30" | 64" | 76" | n/a | 26" | 46 Gal | 81 Gal | n/a | 8.1 Gal |
| OWS-8 | 28" | 30" | 76" | 88" | n/a | 26" | 46 Gal | 81 Gal | n/a | 8.1 Gal |
| OWS-12 | 40" | 30" | 76" | 88" | n/a | 38" | 70 Gal | 122 Gal | n/a | 8.1 Gal |
| OWS-18 | 40" | 30" | 88" | n/a | 60" | 24" | 70 Gal | n/a | 130 Gal | 12.2 Gal |
| OWS-24 | 52" | 30" | 88" | n/a | 60" | 24" | 93 Gal | n/a | 173 Gal | 12.2 Gal |
| OWS-36 | 52" | 42" | 88" | n/a | 72" | 24" | 133 Gal | n/a | 212 Gal | 17.8 Gal |
| OWS-45 | 64" | 42" | 88" | n/a | 72" | 24" | 166 Gal | n/a | 265 Gal | 17.8 Gal |
| OWS-72 | 100" | 42" | 88" | n/a | 72" | 24" | 266 Gal | n/a | 425 Gal | 17.8 Gal |


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# OIL WATER SEPARATORS – OWS SERIES

## Specification Chart:

| Part Number | HQ PAC | | ½" Packing | | ¾" Packing | | 1¼" Packing | | Slant Plate | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oil (0.9) | Gas (0.72) | Oil (0.9) | Gas (0.72) | Oil (0.9) | Gas (0.72) | Oil (0.9) | Gas (0.72) | Oil (0.9) | Gas (0.72) |
| OWS-2 | 9.7 | 27.0 | 5.0 | 14.1 | 3.5 | 9.8 | 2.3 | 6.3 | 0.9 | 2.5 |
| OWS-4 | 19.3 | 54.0 | 10.1 | 28.2 | 7.0 | 19.7 | 4.5 | 12.7 | 1.8 | 4.9 |
| OWS-8 | 38.6 | 108.1 | 20.2 | 56.5 | 14.0 | 39.3 | *9.1* | *25.4* | *3.5* | *9.8* |
| OWS-12 | 57.9 | 162.1 | 30.3 | 84.7 | 21.1 | 59.0 | 13.6 | 38.1 | 5.3 | 14.7 |
| OWS-18 | 86.9 | 243.2 | 45.4 | 127.1 | 31.6 | 88.4 | 20.4 | 57.1 | 7.9 | 22.1 |
| OWS-24 | 115.8 | 324.2 | 60.5 | 169.5 | 42.1 | 117.9 | 27.2 | 76.1 | 10.5 | 29.5 |
| OWS-36 | 159.2 | 445.8 | 68.1 | 190.7 | 47.4 | 132.6 | 30.6 | 85.7 | 11.8 | 33.2 |
| OWS-45 | 199.0 | 557.3 | 85.1 | 238.4 | 59.2 | 165.8 | 38.2 | 107.1 | 14.8 | 41.5 |
| OWS-72 | 318.5 | 891.7 | 136.2 | 381.4 | 94.7 | 265.3 | 61.2 | 171.3 | 23.7 | 66.3 |

Rated US GPM (Based on 25 micron particles at 65 deg F and design safety factor of 1.25)
Larger spaced packing will not plug as quickly as closely spaced packing allowing longer intervals between maintenance requirements. The coalescing slant plate should be used in applications with heavy sludge loads because it does not foul quickly.

## Options Table:

| Option | Description |
|---|---|
| Stand | The separator will be elevated above ground to assist in gravity discharge or to provide room underneath the separator for blowers and pumps. This replaces the standard foot mounts. The maximum stand height for 8' clearance is 36" for OWS-18 and OWS-24 and 24" for OWS-36 and larger. |
| Oversize Pump-out (Extended) | OWS-2, OWS-4, OWS-8 and OWS-12 only. The final section of the separator can be oversized to allow a greater water pump-out volume. For the OWS-2, OWS-4, OWS-8 and OWS-12 the oversized pump-out will be an extended length of the final section of the separator. |
| Oversize Pump-out (Elevated) | OWS-18, OWS-24, OWS-36 and OWS-45 only. The final section of the separator can be oversized to allow a greater water pump-out volume. For the OWS-18, OWS-24, OWS-36 and OWS-45 the separator will be raised on a stand and the final section will extend to the ground to give the oversized volume. |
| Top Inlet | A top mounted option is available to allow for pre-separation of air and liquid at the inlet to the separator. |
| Product Storage Tank | A tank may be mounted on the front of the separator to collect the oil from the skimmer. The volume of the product storage tank is:<br>OWS-2, OWS-4, OWS-8 and OWS-12: 8.1 US Gal<br>OWS-18, OWS-24 12.2 US Gal<br>OWS-36, OWS-45 17.8 US Gal |
| Teleretle Basket | A teleretle basket may be added to allow for a high surface area polishing media for final hydrocarbon removal. |
| Oversize Inlet and Outlet | The inlet and outlet couplings may be increased by one size to allow for higher flow through the separator. |
| Stainless Steel | Each separator can be purchased with Stainless Steel construction instead of the standard Carbon Steel. |
| Main Tank Low Coupling | Additional couplings may be added to allow for the installation of a low level switch in the main separator tank. NOTE: This option covers only the cost of installing the coupling, the switches must be purchased separately. |
| Main Tank High High Coupling | Additional couplings may be added to allow for the installation of a high high level switch in the main separator tank. NOTE: This option covers only the cost of installing the coupling, the switches must be purchased separately. |
| Custom Size | A custom sized separator can be designed to meet specific project needs. |
| Media | Custom media available for contaminants other than oil/BTEX such as chlorinated solvents and other DNAPL products |
| DNAPL Separation | The separator can be supplied with a DNAPL sump to capture heavy fluids and solids and allow collection below the media of the oil water separator. |

**Sample Ordering Format:**

OWS-4 with ½" Packing
SG: 0.9
Temp: 65 deg F
Minimum Micron Size: 25
Design Safety Factor: 1.25
Options:
Oversize Pumpout (Extended)
Product Storage Tank
Stand: 24"

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# ATB 3 and ATS3 Series Spec Sheet
# Level Switch - Small Size - Heavy Duty



The ATB3 is designed for high or low level alarm or switch point applications in rugged situations similar to oil tank reservoirs or industry vessels that require a more robust level switch. Notice the larger brass one piece machined hex to get a wrench on - this model also has an optional brass set screw locking collar in place of the clip.

Internal reed switch selection is the same Almeg quality standard but we've beefed up the external part as well as fully encapsulated the reed switch to maintain a complete moisture free environment. The leads are wire wrapped (not clipped) soldered and heat shrink sealed to the reed switch before encapsulating.

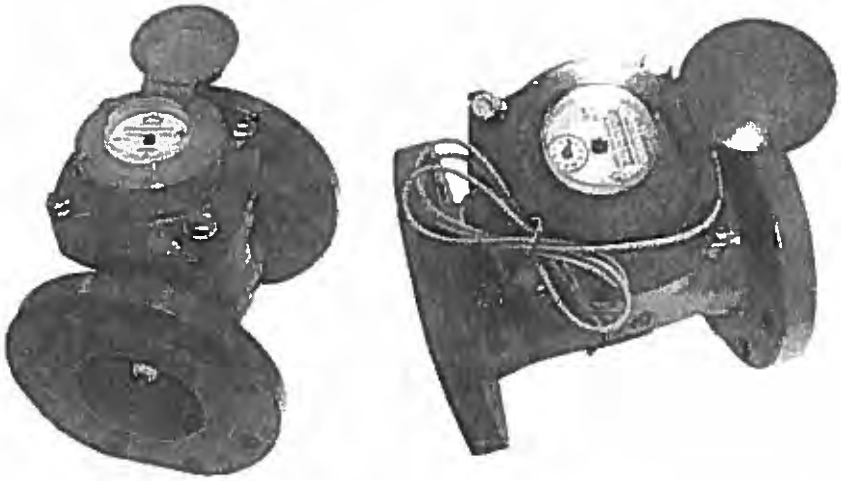
The TRUE closed cell Buna float will not swell or take on moisture - even if cut or drilled. It is designed like a tight bee hive or honey comb construction.

100% of our controls are tested before shipping.

The ATB3 is available in a single order or OEM applications.

# DLJ Epoxy Coated Cast Iron Turbine Meters

200T, 250T, 300T, 400T, 600T, 800T



## Description

**Operation** DLJ Turbine Meters are horizontal Woltman type water meters designed for installation where occasional low and moderate to high sustained flows are demanded. Water flow drives a vertical impeller in direct proportion to the quantity of water passing through the meter. Impeller revolutions are transferred to the register assembly through a reduction gear and magnetic drive.

**Compliance** The DLJ Turbine Meters comply with AWWA C701 and ISO 4064 Class B standards.

**Installation** The meter must be installed in a clean pipeline, free of any foreign materials. Install the meter with direction of flow as indicated by the arrow cast into the meter body. You can install the meter vertically or horizontally and the registers are fully revolvable for ease of reading. It is recommended to strain the incoming water to prevent foreign debris damage and to reduce the effects of water turbulence.

**Application** The DLJ Cold Water Turbine Meters are for use only with cold water up to 120 degrees F (50 degrees C)

**Construction** The meter consists of a fully epoxy coated cast iron main case with the flow direction cast into it and a removable measuring element for easy maintenance.

| | Specifications | | | | | |
|---|---|---|---|---|---|---|
| **Characteristics** | **DLJ 200T 2"** | **DLJ 250T 2 1/2"** | **DLJ 300T 3"** | **DLJ 400T 4"** | **DLJ 600T 6"** | **DLJ 800T 8"** |
| Flow Rating (gpm) | 325 | 395 | 495 | 1250 | 2500 | 3450 |
| Continuous Flow (gpm) | 250 | 300 | 375 | 1000 | 2000 | 2800 |
| Low Flow (gpm) | 4 | 5 | 6 | 9 | 32 | 38 |
| Maximum Pressure (psi) | 175 | 175 | 175 | 175 | 175 | 175 |
| Maximum Temperature (°F) | 120 | 120 | 120 | 120 | 120 | 120 |
| Sweep Hand Registers (Gallons) | 10/100 | 10/100 | 10/100 | 10/100 | 10/100 | 10/100 |
| Register Capacity (Millions of Gallons) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |

*watermeters.com*

*the first and still the best online source for water meters*

DLJ Meter

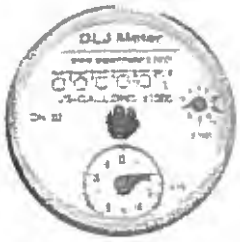


www.watermeters.com

# DLJ Epoxy Coated Cast Iron Turbine Meters

200T, 250T, 300T, 400T, 600T, 800T

**Direct Read Register** The register is contained in a hermetically sealed nylon casing with a 5mm tempered glass lens. The totalizer wheels are large and easy to read and the sweep hands are offset on seperate 10 gallon and 100 gallon register wheels. The large black spinning trickle indicator is excellent for leak detection. Each register clearly show's it's applicable meter size.



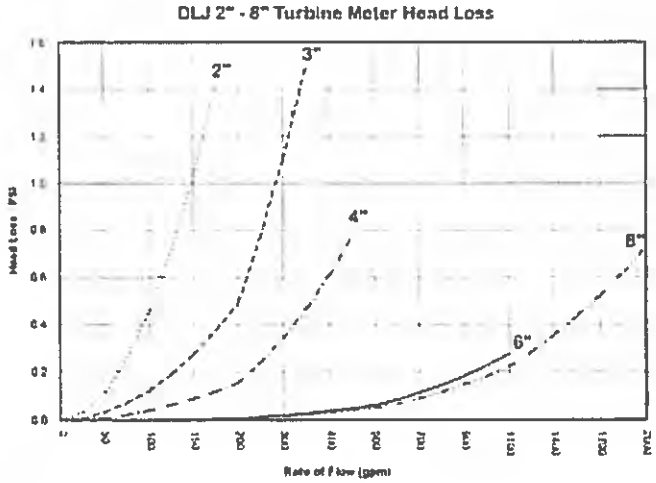

**Pulse Output** The DLJ line is available with a dry contact reed switch pulse output. This requires external DC power, 4 watts, 30VDC maximum. Contact closure is 1 pulse per 100 gallons on the 2 - 3" Turbines and 1 pulse per 1000 gallons on the 4 - 8" Turbines



**Magnetic Drive** The magnetic drive design eliminates all miscouplings associated with conventional right angle drives. Excess torque is eliminated in the encased undergear assembly, ensuring constant magnet coupling.

**Maintenance** The register/measuring assembly is easily removable and replaceable if needed, and doesn't require taking the meter off line.

**Connections** The DLJ Turbine Meters are available with standard Class 150lb ANSI flanges (4 bolt in 2, 2 1/2" and 3", 8 bolt in 4, 6 and 8"). Companion Flange sets in Cast Iron or PVC and Uni-Flanges are available for ease of connection.




| Characteristics | Specifications | | | | | |
|---|---|---|---|---|---|---|
| | DLJ 200T 2" | DLJ 250T 2 1/2" | DLJ 300T 3" | DLJ 400T 4" | DLJ 600T 6" | DLJ 800T 8" |
| Length (Inches) | 12 | 7.75 | 8.75 | 9 75 | 11.6 | 13 6 |
| Weight (Pounds) | 32 | 29 | 35 | 40 | 92 | 141 |
| Crated Weight (Pounds) | 43 | 40 | 47 | 50 | 110 | 150 |


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Hackensack, NJ 07601
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# Stacking Shipping Containers on Land for an Off-Axis Detector

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Fermi National Accelerator Laboratory, Batavia, IL 60510

(May 29, 2003)

## Introduction

Fig. 1 shows a typical International Standards Organization (ISO) Series 1 shipping container.

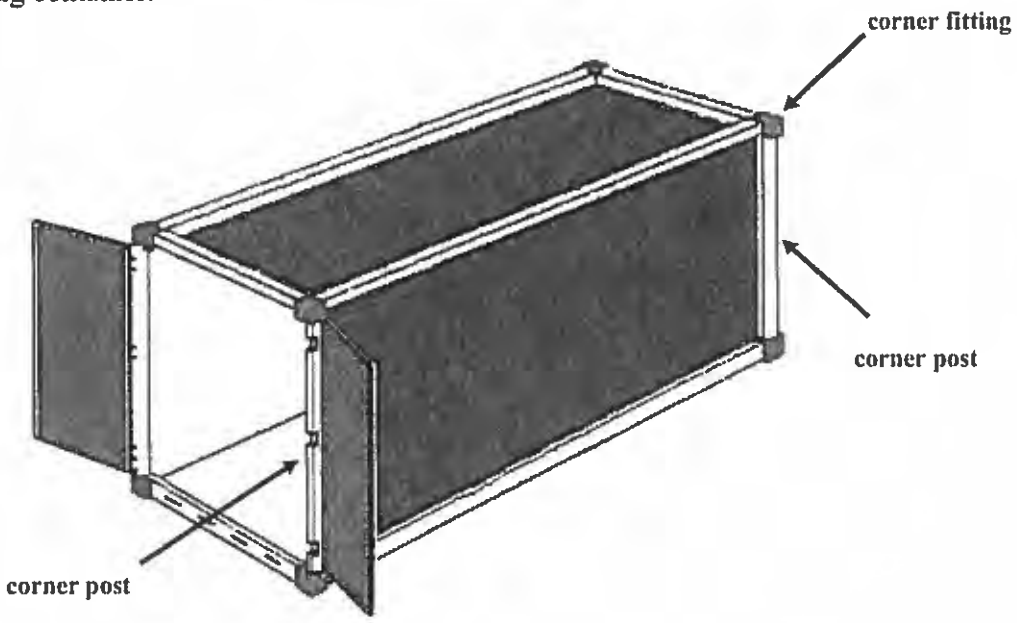



**Figure 1. ISO Series 1 Shipping Container**

These containers are designed to make vertical contact with each other through discrete corner fittings; when stacked, all vertical force is transferred through these fittings, in turn loading the corner posts, and not the walls, of the container. The number of containers which can be stacked on each other is determined by the strength of the corner posts.

ISO Standard 1496[1] states that the corner posts of ISO Series 1 containers should be tested to a load of 86,400 kg (190,480 lbs). This is the load applied to the posts of the bottom container in an 8-on-1 stack of 24,000 kg (gross weight) containers,

multiplied by a factor of 1.8. This extra factor is used to take into account "conditions aboard ship and the relative eccentricities between superimposed containers."[1] The "conditions aboard ship" were derived from a 1964 study of maximum acceleration values under the worst sea and wind conditions.[2]

Calculating the safe stacking height for loaded containers *on land* requires some understanding of the corner posts, their material properties, possible failure modes, and what constitutes an adequate factor of safety.

## Corner Post Geometry and Compressive Load-Bearing Capacity

Corner post steels typically correspond to the specification ASTM A-572, with a yield stress of 47,000 psi, and an ultimate stress of 70,000 psi. This is a low alloy columbium or vanadium steel commonly used for high-strength steel weldments, such as bridges. The load-bearing characteristics of corners posts are complex, because in a walled container the posts receive substantial lateral stability, and compressive cross sectional area, from the participation of the walls and doors.

The corner post can fail in two ways: The first is collapse, or buckling. This occurs in a slender column when the compressive load reaches a critical load $P_{cr}$ which is so large that the column can no longer recover from small lateral displacements along its length. The result is sudden and catastrophic loss of stiffness, and gross deformation of the column and its attached material.

A second type of failure can occur if the compressive load $P_{comp}$ exceeds the value $S_yA$, where $S_y$ is the yield stress of the material, and A is the cross sectional area of the post. Even a column which is stable against buckling failure can fail from compressive yielding. Failures of this type are rare for columns, since the yielding will tend to produce larger cross sectional area through plastic deformation, and eventually become self-limiting. This self-limit may not be reached before even a very short column becomes unstable, however, resulting in a type of collapse that is characterized by large amounts of plastic deformation.

The most likely failure mode, given the substantial lateral constraint offered by the walls, is probably a combination of collapse and gross yielding, a type of failure referred to as elastic/plastic collapse.

The calculation of collapse (buckling) loads for long, slender steel columns uses the Euler equation:

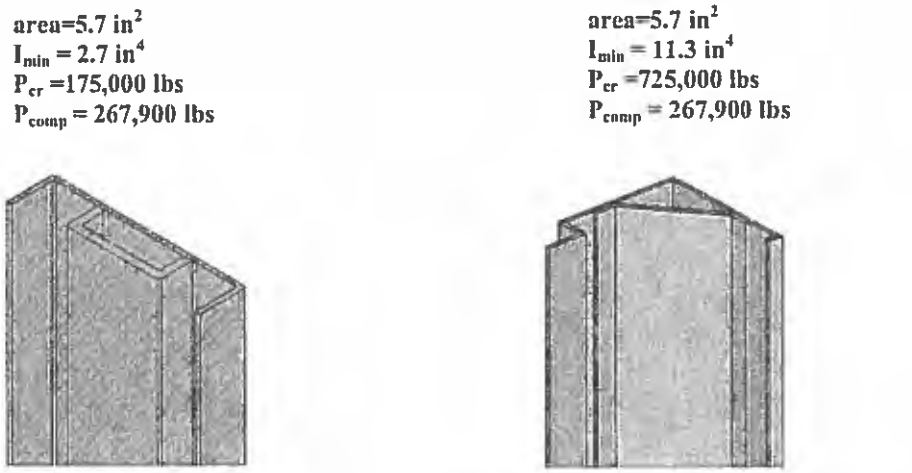
$$P_{cr} = k\pi^2 EI/L^2$$

where $P_{cr}$ = critical (collapse) load
E = modulus of elasticity of steel = 30e6 psi
I = minimum moment of inertia of section
L = length of column
k = factor for end rotational restraint (theoretical range from 1-4)

For the corner posts, the degree of end rotational restraint is difficult to quantify. The top, bottom, and side rails will serve to provide substantial restraint, and even the corner fitting contact of the loading container above a corner post will tend to limit rotation. Therefore, a k factor of 2 is chosen for calculating the estimates of collapse load.[3] This is less than the complete rotational restraint (k = 4), but greater than free rotation (k = 1).

In addition to resisting collapse, the corner post must also work at a compressive stress that is below the yield of the material. Corner posts will yield at a stress of 47,000 psi. Therefore, the minimum cross sectional area for resisting the corner post loads is A = 190,840/47,000 = 4.05 $in^2$.

While the minimum performance of a corner post is standardized via ISO, the actual geometry of the post is not. Manufacturers have explored many different designs for many different types of containers, all of which will pass the ISO test load of 86,400 kg or 190,840 pounds. Figure 2 shows the most common corner post cross-sections at the door and walled ends of a Series 1 container. These posts are made of 6mm thick pressed steel shapes welded together along the length of the post. In the case of the door end post, a piece of hot rolled channel 113 x 40 x 10 mm is welded to the 6mm plate. Both posts in Figure 2 have adequate cross sectional area from the standpoint of compressive stress. However, the Door End post (a), has a collapse load which is less than the load required by the ISO standard, and therefore must rely on interaction with the walls and doors of the container to produce the necessary load-bearing capacity.




**(a) Corner Post at Door End** **(b) Corner Post at Walled End**

**Figure 2. Corner Post Cross Sections -- Properties and Load Capacities without Wall/Door Participation**

The effect of participation of the walls and doors is illustrated in Fig. 3 The profile of Fig. 2(a) has been used with a 3-inch wide strip of adjacent container sidewall (3.6 mm thick) and a 2-inch wide strip of door panel (2 mm thick), to form a column of considerably higher strength than the profile of Fig. 2(a) alone. The cross section shown, with walls, has a critical load of approximately 252,000 lbs, which is well above the 175,000 lbs of the corner post alone, and well above the 190,480 lbs required by the ISO Standard.

These calculations show that the door is an important part of the load path under stacking, providing additional cross-sectional area for compression and stability. The door also acts as a sheer wall, preventing the parallelogram deformation of the end referred to as "racking" or "sidesway." For these reasons, in commercial practice, the doors on a container within a stack are presumably never opened. This is not a constraint on the way the containers are used in commerce, since only one container at a time is loaded or unloaded at terminals, with stacking occurring only during transit.

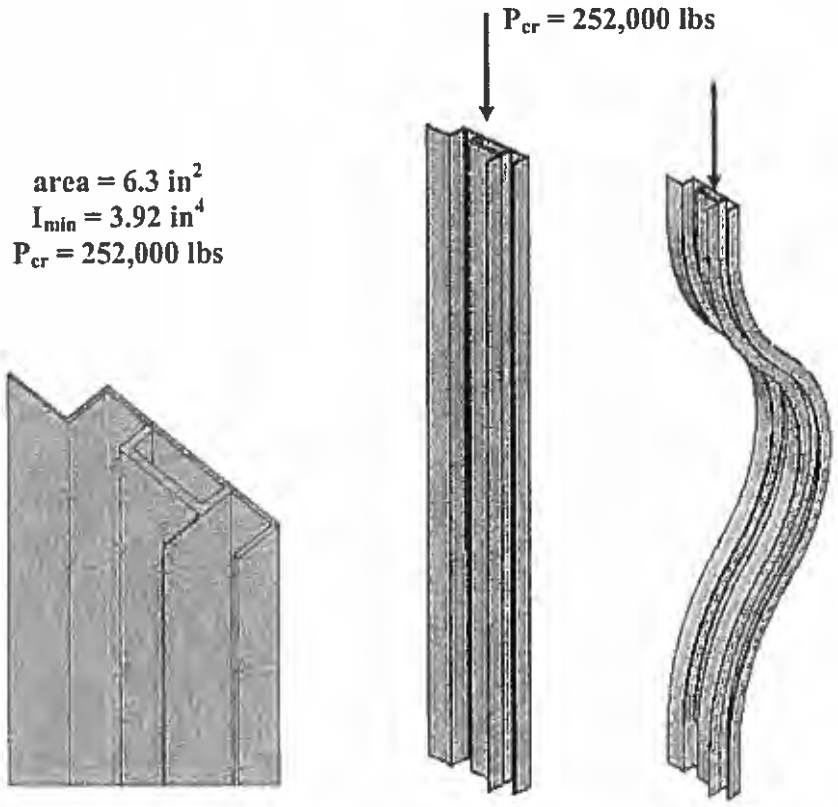



**Figure 3. Corner Post from Fig. 2(a) showing increase in buckling strength due to participation of wall**

## Corner Fittings

The corner fittings shown in Figure 1 are an integral part of the load-bearing column in the container. ISO 1161-1984(E)[4] states "Corner fittings for Series 1 freight containers shall be capable of withstanding the loads calculated in accordance with the requirements of ISO 1496/1 for Series 1 containers." This means that the bottom corner fitting of the bottom container in a stack must withstand the weight of the containers stacked above it, plus the weight of the bottom container itself. The maximum load which a single corner fitting must take is then

$$P_{tot} = 190{,}480 + (52{,}800/4) = 203{,}680 \text{ lbs}$$

A typical corner fitting is shown in Fig. 4.. The cross sectional area of this fitting is shown in Fig. 5. The total cross sectional area available for compression is 10.15 $in^2$. This results in an average compressive stress under maximum load of 20,067 psi.

Corner fittings are typically cast and machined from A-216 steel, which has a minimum specified yield stress of 40,000 psi. Therefore, under maximum load, a corner fitting of the cross section shown below operates with a safety factor on yield of nearly 2.0

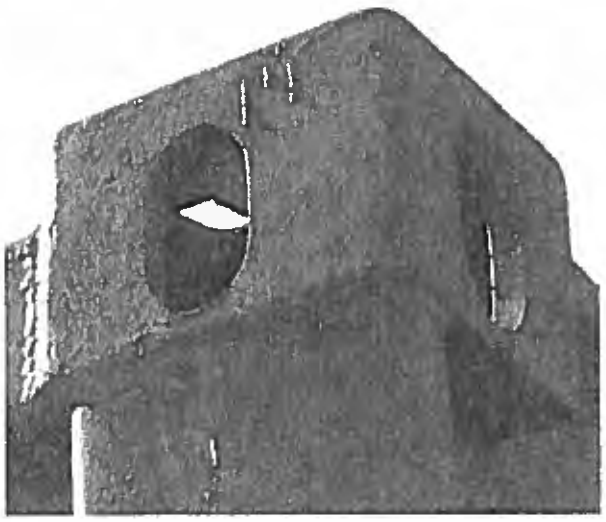


Figure 4. Corner Fitting

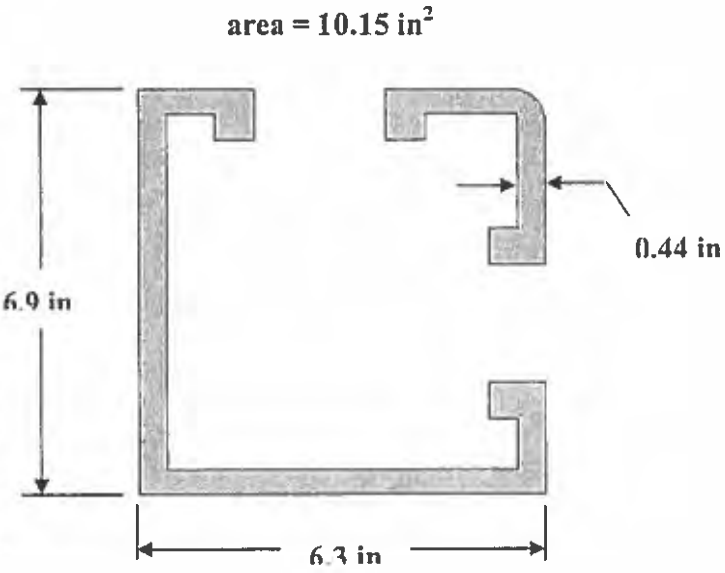



Figure 5. Fitting Cross Section

## Safety Factor for Stacking Containers on Land

A safety factor for the corner posts in the bottom container of a stack can be defined as

$$SF = F_{cp\text{-}fail}/F_{cp\text{-}act}$$

where SF = safety factor
$F_{cp\text{-}act}$ = actual operating load on corner post
$F_{cp\text{-}fail}$ = failure load of corner post

The ISO Standard, however, does not define a force $F_{cp\text{-}fail}$; rather, it specifies the load that each corner post must withstand *without* failure. In this sense, the specified load is a *proof* load, $F_{cp_proof}$, which is simply a load which each corner post must be shown capable of resisting. For the purposes of calculating a safety factor, the specified test load can be thought of as an absolute lower limit on the failure load. Any safety factor calculated with $F_{cp\text{-}fail} = F_{cp_proof}$ will be smaller than the actual safety factor, since $F_{cp_proof}$ is always smaller than $F_{cp\text{-}fail}$.

Using the expression above, the safety factor of an 8-on-1 stack of containers on land is at least 1.8 . Safety factors in engineering commonly range from 1.25 to 2.0 or greater, depending on the amount of confidence the designer has in material performance and load characterization. The AISC Steel Construction Code[5], for example, uses a safety factor of 2 for column loading; however, conservative design in civil structures is necessary because there is typically no load-testing of the parts; they are designed, manufactured, and set in place with only the calculation and fabrication standards serving as proof of merit. Aircraft design, however, uses safety factors closer to 1.25, due to the great penalties incurred by excess weight. The extremely rigorous materials and testing programs common in the aviation industry justify these smaller safety factors.

Because the corner posts of all containers are known to have been tested to the load stipulated by ISO 1496 with no failures occurring at a load that is less than the test load, a safety factor of about 1.5 is adequate for a stack of containers on land. Table I shows the safety factor on the corner post loading of the bottom container in a stack, for stacks of various heights. This table is based on the application of the equation for safety factor, with $F_{cp\text{-}fail} = F_{cp\text{-}proof} = 190{,}480$ lbs, and containers of 52,910 lbs gross weight:

**Table I. Safety Factors on Land for Various Stack Heights on Land with Container Corner Post Capacity of 190,480 lbs (86,400 kg)**

| Number of Containers Stacked on One | Total Height of Stack | Safety Factor on Corner Post Loading |
|---|---|---|
| 8 | 9 | 1.80 |
| 9 | 10 | 1.60 |
| 10 | 11 | 1.44 |
| 11 | 12 | 1.31 |

The table shows that we can stack 9-on-1 on land, and maintain a safety factor of greater than 1.5.

## Possible Modifications

For a final detector design, good engineering practice would require that the corner posts of several containers be loaded to failure to more precisely determine $F_{cp_fail}$, from which more accurate stacking safety factors could be calculated. Some advantage might be taken of the fact that while $F_{cp\text{-}fail}$ is not known, it is certainly higher than 190,480 lbs (86,400 kg). If the measured failure load is just 4% higher than the test (proof) load, the safety factor on a 10-on-1 stack becomes 1.5, and stacking to that height becomes defensible.

Some vendors advertise containers with a higher capacity[(6)] than the ISO Series 1 standard, and advantage could be taken of the greater payload, as well as the higher post strength, in configuring the detector array. The typical higher post rating quoted is 214,290 lbs (97,400 kg), allowing exactly 9 on 1 stacking of 52,910 lb (24,000 kg) containers at sea and therefore allowing 10 on 1 on land with a safety factor of (9/8)*(1.44) = 1.62.

Similarly, if the Off-Axis detector density is small enough that our standard gross weight container is less than 52,910 lbs (24,000 kg), then even higher stacks could be supported. Table II shows the stack heights possible when the higher strength containers are used. A container volume of 33.2 $m^3$ is assumed with a tare weight of 2,250 kg and four different detector gross weights of 22,150 kg, 24,000 kg, 26,000 kg and 30,480 kg. The 30,480 kg number is the vendor quoted maximum gross weight for the higher strength containers. Comparing Tables I and II shows that the higher strength posts lead to the same height stacks as the lower strength posts for containers of density 0.75 gm/cc vs. 0.66 gm/cc.

**Table II. Stack Heights on Land forVarious Detector Densities with Container Corner Post Capacity of 214,290 lbs (97,400 kg)**

| Number of Containers Stacked on One | Total Height of Stack (m) | Safety Factor on Corner Post Loading | | | |
|---|---|---|---|---|---|
| | | with payload density = **0.60 g/cc** (22,150 kg gross) | with payload density = **0.66 g/cc** (24,000 kg gross) | with payload density = **0.75 g/cc** (27,150 kg gross) | with payload density = **0.85 g/cc** (30,480 kg gross) |
| 8 on 1 | 23.3 | 2.20 | 2.03 | 1.80 | 1.60 |
| 9 on 1 | 25.9 | 1.95 | 1.80 | 1.59 | 1.42 |
| 10 on 1 | 28.5 | 1.76 | 1.62 | 1.43 | 1.28 |
| 11 on 1 | 31.1 | 1.60 | 1.48 | 1.30 | 1.16 |

## Conclusion

Stacking ISO containers 10 high on land is reasonable, and stacks as high as 12 may be possible depending on the type of container purchased and on the loading of the container with Off-Axis detector elements. For a final detector design, good engineering practice would require that the corner posts of the selected containers be loaded to failure to more accurately determine the safety factor of the stacked array.

**References**


1. ISO 1496-1:1990 *Series 1 freight containers – Specification and testing – Part 1: General cargo containers for general purposes*

2. ISO/TR 15070:1996(E) *Series 1 freight containers – Rationale for structural test criteria*

3. "Commentary on the Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", Section 1.8, American Institute of Steel Construction, 1978

4. ISO 1161-1984(E) *Series 1 freight containers – Corner fittings – Specification*

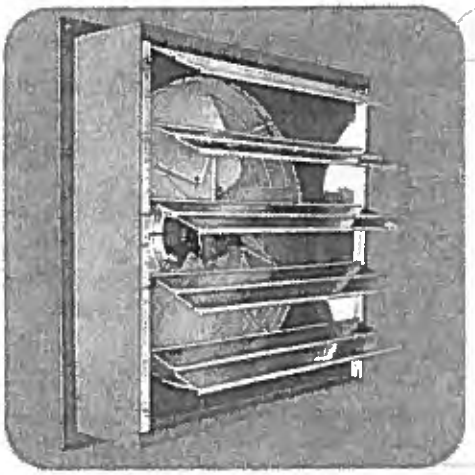
5. "Commentary on the Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", Section 1.5.1.3, American Institute of Steel Construction, 1978

6. We have several specification documents from container vendors that stipulate a higher load capacity, but no details on just how this is accomplished by any container manufacturer via changes in the post configuration. We suspect that these vendors may just be taking advantage of a specification requiring a higher measured failure load as discussed in the preceding paragraph. After all, our post calculations for Figures 2(b) and Figure 3 indicate that these "standard" posts should easily pass a failure load test at 214,290 lbs vs. the original ISO test at 190,480 lbs.

# STANDARD FANS

**Efficient • Low Maintenance • Easy Installation**

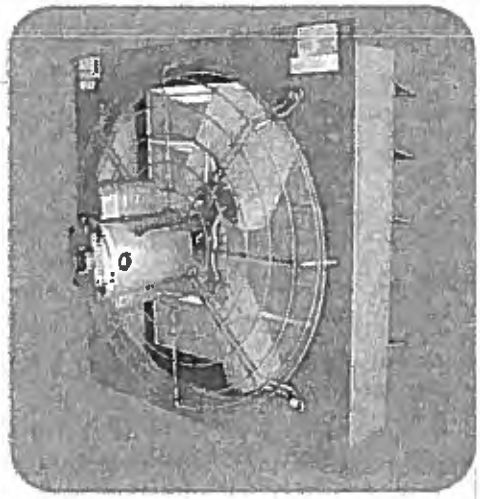
***Canarm's Standard Fans follow a tradition of quality in design, materials and construction.***



## Features

- Available in 8" to 36" sizes.
- Single, two and variable speed models are available.
- All fans use a totally enclosed, ball bearing motor with thermal overload protection.
- The motor mount is manufactured with heavy welded rods and has a powder coated finish.
- The fan blades are well-balanced, heavy gauge aluminum.
- The rugged steel welded box housing has a durable powder coated finish.
- Aluminum louver shutters are supported by long life nylon bushings (30" and 36" have PVC louvers).
- All fans are shipped completely assembled.

## General Information



Canarm's Standard Fans follow a tradition of quality in design, materials and construction. All our Standard Fans are developed to be efficient and economically priced. All variable speed Standard Fans use an energy efficient variable speed, dual voltage motor and blade combination.

*To determine the proper Canarm Fan for your applications, use the following formula.*

**Number of cubic feet in room / Number of minutes per air change = Required C.F.M. Capacity**

*****Example*****

*A general office, (see chart) which requires an air change every ten minutes, would require the following fan capacity. If office is 100' x 40' x 10' = 40,000 cubic feet*

**40,000 cubic feet / 10 minutes per air change = 4000 Required C.F.M.**

*From the "Performance Data" section on the back of this page, you would select a fan that is rated at 4000 C.F.M. at 1/8" S.P. (Static Pressure)*

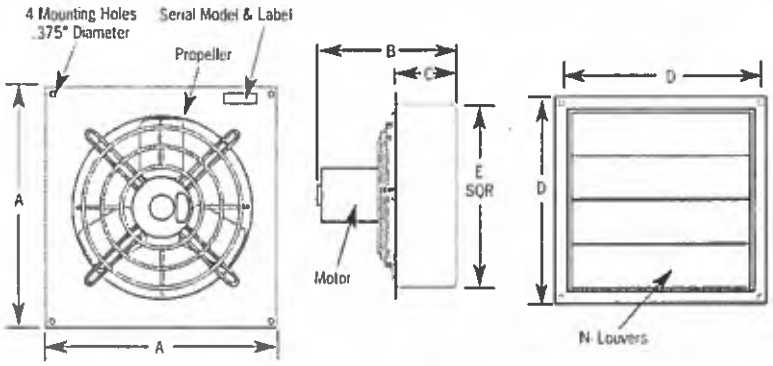
## Fan Selection Chart

| Application | Minutes per Air Change | Application | Minutes per Air Change | Application | Minutes per Air Change |
|---|---|---|---|---|---|
| Assembly Hall | 7 | Department Store | 6 | Plating Room | 3 |
| Auditorium | 10 | Dry Cleaning | 5 | Pressing Room | 1 |
| Bakery | 3 | Engine Room | 6 | Projection Booth | 2 |
| Barber Shop | 6 | Forge Room | 3 | Restaurant | 6 |
| Basement | 8 | Foundry | 4 | School | 7 |
| Battery Room | 4 | Garage | 5 | Summer Cooling | 1 |
| Boiler Room | 1 | General Office | 10 | Store | 8 |
| Bowling Alley | 5 | Gymnasium | 8 | Tavern | 3 |
| Church | 15 | Hospital | 8 | Toilet | 3 |
| Cocktail Bar | 3 | Kitchen | 2 | Transformer Room | 1 |
| Corridor | 10 | Laundry | 2 | Warehouse | 12 |
| Dairy | 4 | Locker Room | 3 | Welding Shop | 2 |
| | | Machine Shop | 8 | | |

# STANDARD FANS

## Fan Dimensions

| Fan Auto | A | B | C | D (c/c) | E | N |
|---|---|---|---|---|---|---|
| 8" | 13 1/4" | 10" | 4" | 12" | 10 3/4" | 2 |
| 10" | 15 1/4" | 10" | 4" | 14" | 12 3/4" | 2 |
| 12" | 17 1/4" | 14" | 6" | 16" | 14 3/4" | 3 |
| 14" | 19 1/4" | 14" | 6" | 18" | 16 3/4" | 3 |
| 16" | 21 1/4" | 14" | 6" | 20" | 18 3/4" | 4 |
| 18" | 23 1/4" | 15" | 6" | 22" | 20 3/4" | 4 |
| 20" | 25 1/4" | 16" | 6" | 24" | 22 3/4" | 5 |
| 24" | 29 1/4" | 16" | 6" | 28" | 26 3/4" | 5 |
| 30" | 35 1/4" | 19" | 6" | 34" | 32 3/4" | 16 |
| 36" | 41 1/4" | 16" | 6" | 40" | 38 3/4" | 20 |




## Performance Data & Specifications

| Model Number | Fan Size | Motor HP | Operation Speed | Fan RPM | Current Load Amps @ 115V | Current Load Amps @230V | Input Watts | Airflow Capacity - CFM 0" S.P. | .10" S.P. | .125" S.P. | .25" S.P. | CFM Watts | Sound Level Decibel (A) | Framing Dimensions | Shipping Weight Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S8-B2 | 8" | 1/20 | Two | High 1550<br>Low 1300 | 0.95<br>0.45 | -<br>- | 109 | 360<br>300 | 270<br>150 | 230<br>110 | 0<br>0 | 2.5 | 48<br>43 | 11" x 11" | 12 |
| S10-B2 | 10" | 1/20 | Two | High 1550<br>Low 1300 | 1.2<br>0 7 | -<br>- | 125 | 690<br>580 | 590<br>460 | 570<br>390 | 0<br>0 | 4.72 | 56<br>50 | 13" x 13" | 13 |
| S12-E1 | 12" | 1/4 | Single | 1750 | 3.5 | - | 245 | 1,640 | 1,540 | 1,510 | 1,390 | 6.00 | 63 | 15" x 15" | 28 |
| S12-E2 | | | Two | High 1760<br>Low 1180 | 3.4<br>2.3 | -<br>- | 230<br>132 | 1,650<br>1,090 | 1,550<br>950 | 1,520<br>930 | 1,390<br>- | 6.74<br>7.31 | 64<br>50 | | 32 |
| SD12-EV | | | Variable | Max 1625<br>Min 600 | 2.2 | 1.1 | 205 | 1,650<br>560 | 1,540<br>440 | 1,510<br>420 | 1,390<br>- | 7.50 | 60<br>- | | 32 |
| S14-E1 | 14" | 1/4 | Single | 1740 | 3.6 | - | 257 | 2,170 | 2,070 | 2,030 | 1,860 | 8.05 | 67 | 17" x 17" | 30 |
| S14-E2 | | | Two | High 1740<br>Low 1170 | 3.8<br>2.2 | -<br>- | 253<br>137 | 2,180<br>1,350 | 2,080<br>1,190 | 2,060<br>1,160 | 1,890<br>- | 8.22<br>8.69 | 65<br>53 | | 34 |
| S16-E1 | 16" | 1/4 | Single | 1740 | 3.7 | - | 274 | 2,370 | 2,270 | 2,210 | 2,060 | 8.28 | 68 | 19" x 19" | 33 |
| S16-E2 | | | Two | High 1740<br>Low 1170 | 3.7<br>2.3 | -<br>- | 270<br>152 | 2,380<br>1,640 | 2,280<br>1,490 | 2,230<br>1,430 | 2,070<br>- | 8.44<br>9.80 | 69<br>55 | | 36 |
| SD16-EV | | | Variable | Max 1625<br>Min 450 | 2.6 | 1.3 | 248 | 2,370<br>610 | 2,270<br>580 | 2,210<br>570 | 2,063<br>- | 9.15 | 63<br>- | | 36 |
| S18-F1 | 18" | 1/3 | Single | 1700 | 4.8 | - | 448 | 3,200 | 3,090 | 3,040 | 2,920 | 6.89 | 73 | 21" x 21" | 37 |
| S18-F2 | | | Two | High 1700<br>Low 1140 | 5.7<br>3.1 | -<br>- | 446<br>250 | 3,200<br>2,100 | 3,090<br>1,890 | 3,040<br>1,820 | 2,920<br>- | 6.93<br>7.56 | 74<br>64 | | 43 |
| SD18-FV | | | Variable | Max 1625<br>Min 390 | 3..7 | 1.9 | 378 | 3,150<br>700 | 3,050<br>650 | 2,980<br>630 | 2,860<br>- | 8.07 | 74<br>- | | 45 |
| S20-F1 | 20" | 1/3 | Single | 1735 | 4.8 | - | 322 | 3,420 | 3,220 | 3,170 | 2,920 | 10.00 | 77 | 23" x 23" | 41 |
| S20-F2 | | | Two | High 1745<br>Low 1165 | 4.3<br>2.6 | -<br>- | 315<br>190 | 3,440<br>2,300 | 3,240<br>2,000 | 3,180<br>1,950 | 2,930<br>- | 10.20<br>10.52 | 77<br>67 | | 45 |
| SD24-F1 | 24" | 1/3 | Single | 1075 | 4.3 | - | 370 | 5,000 | 4,500 | 4,300 | 3,600 | 12.80 | 70 | 27" x 27" | 46 |
| SD24-GV | | 1/2 | Variable | Max 1100<br>Min 310 | 4.2 | 2.1 | 290 | 5,050<br>800 | 4,940<br>710 | 4,810<br>650 | 4,400<br>- | 13.2 | 72<br>- | | 56 |
| SD30-G1D | 30" | 1/2 | Single | 1075 | 4.6 | 2.3 | 600 | 8,000 | 7,000 | 6,000 | 5,000 | 11.5 | 82 | 33" x 33" | 72 |
| SD36-G1D | 36" | 1/2 | Single | 850 | 6.0 | 3.0 | 660 | 12,000 | 11,000 | 10,500 | 9,500 | 13.0 | 72 | 39" x 39" | 88 |

***NOTE: RPM Min (Minimum) is determined when louvers are opened one inch***

**Note:** Wind has a significant effect on exhaust fans. A 10 mph wind creates a 0.05" pressure against the fan. A 20 mph wind creates 0.20" pressure and 30 mph a 0.45" pressure. These pressures are in addition to the static pressure in the building. Wind blocks or hoods should be included in all designs where fans will be subjected to winds above 10 mph.

## Warranty

- 1 year on all components


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E-Mail: **agsales@canarm.ca**



Subject to Change without notice.



Printed in Canada - 01/05

Code No. LIT-1927010
Issued February 1, 2009

A19 Series

# Remote Bulb Control

## Description

The A19 Series are single-stage temperature controls that incorporate environmentally friendly liquid-filled sensing elements.

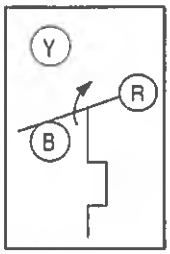
## Features

- wide temperature ranges available
- constant differential throughout the entire range
- compact enclosure
- fixed or adjustable differential available
- variety of sensing element styles
- unaffected by cross-ambient conditions

## Applications

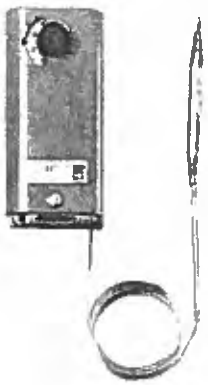
The A19 is suitable for temperature control in heating, ventilating, air conditioning, and refrigeration.

A19 Series




Action on Increase of Temperature

**A19 Series**
**Terminal Arrangement for SPDT**



**A19ABC-24**

## Selection Charts

**A19 Series Remote Bulb Control**[1]

| Code Number | Switch Action | Range °F (°C) | Diff F° (C°) | Bulb and Capillary | Bulb Well No. (order separately) | Range Adjuster | Max. Bulb Temp. °F (°C) |
|---|---|---|---|---|---|---|---|
| **Adjustable Differential (Wide Range)** | | | | | | | |
| A19ABA-40C [2] | SPST Open Low | -30 to 100 (-34 to 38) | 3 to 12 (1.7 to 6.7) | 3/8 in. x 4 in., 6 ft. Cap | WEL14A-602R | Screwdriver Slot | 140 (60) |
| A19ABC-4C | SPDT | 50 to 130 (10 to 55) | 3 1/2 to 14 (1.9 to 8) | 3/8 in. x 5 in., 8 ft. Cap. | WEL14A-603R | Knob | 170 (77) |
| A19ABC-24C [3] | SPDT | -30 to 100 (-34 to 38) | 3 to 12 (1.7 to 6.7) | 3/8 in. x 4 in., 8 ft. Cap. | WEL14A-602R | Convertible | 140 (60) |
| A19ABC-36C | SPDT | -30 to 100 (-34 to 38) | 3 to 12 (1.7 to 6.7) | 3/8 in. x 4 in., 20 ft. Cap. | WEL14A-602R | Convertible | 140 (60) |
| A19ABC-37C | SPDT | -30 to 100 (-34 to 38) | 3 to 12 (1.7 to 6.7) | 3/8 in. x 4 in., 10 ft. Cap. | WEL14A-602R | Screwdriver slot | 140 (60) |
| A19ABC-74C | SPDT | -30 to 100 (-34 to 38) | 3 to 12 (1.7 to 6.7) | 3/8 in. x 4 in., 6 ft. Cap. | WEL14A-602R | Screwdriver slot | 140 (60) |
| **Fixed Differential** | | | | | | | |
| A19AAF-12C | SPDT | 25 to 225 (-4 to 107) | 3 1/2 (1.9) | 3/8 in. x 3 in., 10 ft. Cap. | WEL14A-602R | Screwdriver slot | 275 (135) |
| **Fixed Differential (Case Compensated)** | | | | | | | |
| A19AAC-4C | SPDT | 0 to 80 (-18 to 27) | 5 (2.8) | 3/8 in. x 4 in., 6 ft. Cap. | WEL14A-602R | Screwdriver slot | 140 (60) |
| A19AAD-12C | SPST Open Low | -30 to 50 (-34 to 10) | 2 1/2 (1.4) | 3/8 in. x 4 in., 7 ft. Cap. | WEL14A-602R | Screwdriver slot | 140 (60) |
| **Fixed Differential (Close)** | | | | | | | |
| A19AAD-5C [4] | SPST Open Low | 30 to 50 (-1 to 10) (Bulk Milk Cooler) | 2 1/2 (1.4) | 3/8 in. x 2 5/8 in., 6 ft. Cap | WEL16A-601R | Screwdriver slot | 190 (88) |
| A19AAF-20C | SPDT | -30 to 100 (-34 to 38) | 2 1/2 (1.4) | 3/8 in. x 4 in., 6 ft. Cap. | WEL14A-602R | Screwdriver slot | 140 (60) |
| A19AAF-21C | SPDT | 40 to 90 (4 to 32) | 1 1/2 (0.8) | 3/8 in. x 5 3/4 in., 6 ft. Cap. | WEL14A-603R | Screwdriver slot | 140 (60) |
| **Manual Reset** | | | | | | | |
| A19ACA-14C | SPST Open Low | -30 to 100 (-34 to 38) | Manual Reset | 3/8 in. x 4 in. 6 ft. Cap | WEL14A-602R | Screwdriver slot | 140 (60) |
| A19ACA-15C | SPST Open Low | -30 to 100 (-34 to 38) | Manual Reset | 3/8 in. x 4 in. 10 ft. Cap | WEL14A-602R | Screwdriver slot | 140 (60) |
| A19ADB-1C | SPST Open High | 100 to 240 (38 to 116) | Manual Reset | 3/8 in. x 3 1/2 in. 6 ft. Cap. | WEL14A-602R | Knob | 290 (143) |
| A19ADN-1C | SPST Open High | 100 to 240 (38 to 116) | Manual Reset | 3/8 in. x 4 in. 6 ft. Cap | WEL14A-602R | Screwdriver slot | 290 (143) |

1 Specify the control model code number, packing nut code number (if required), and bulb well code number (if required).
2 Replaces White-Rodgers 1609-101
3 Replaces White-Rodgers 1609-12, -13, Ranco 010-1408, -1409, -1410, -1490, 060-110, Honeywell L6018C-1006, L6021A-1005, T675A-1011, -1508, -1516, -1821, T4301A-1008, T6031A-1011, T6031A-1029
4 Case-Compensated

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

# *Remote Bulb Control (Continued)*

## Selection Charts (Continued)

**Replacement Parts**

| Code Number | Description |
|---|---|
| CVR28A-617R | Concealed adjustment cover |
| CVR28A-618R | Visible scale cover |
| KNB20A-602R | Replacement Knob Kit |

## Accessories

A packing nut is available for closed tank application.
Specify the part number **FTG13A-600R.**

Bulb wells (WEL14A Series) are available for liquid immersion applications.
Refer to the selection chart or to *Bulb Wells Catalog Page, LIT-1922135.*

## Technical Specifications

**Electrical Ratings**

| Motor Ratings VAC | 120 | 208 | 240 |
|---|---|---|---|
| **Wide Range – Adjustable Differential** | | | |
| AC Full Load A | 16.0 | 9.2 | 8.0 |
| AC Locked Rotor A | 96.0 | 55.2 | 48.0 |
| Non-Inductive A [1] | 22 A, 120 to 277 VAC | | |
| Pilot Duty – 125 VA, 24 to 600 VAC | | | |
| **Fixed Differential and Close Differential** | | | |
| AC Full Load A | 6.0 | 3.4 | 3.0 |
| AC Locked Rotor A | 36.0 | 20.4 | 18.0 |
| Non-Inductive A | 10 A, 24 to 277 VAC | | |
| Pilot Duty – 125 VA, 24 to 277 VAC | | | |
| **Case Compensated – Fixed Differential A19AAC-4** | | | |
| AC Full Load A | 16.0 | 9.2 | 8.0 |
| AC Locked Rotor A | 96.0 | 55.2 | 48.0 |
| Non-Inductive A [1] | 22 A, 120 to 277 VAC | | |
| Pilot Duty – 125 VA, 24 to 600 VAC | | | |
| **A19AAD-12** | | | |
| AC Full Load A | 6.0 | 3.4 | 3.0 |
| AC Locked Rotor A | 36.0 | 20.4 | 18.0 |
| Non-Inductive A | 10 A, 24 to 277 VAC | | |
| Pilot Duty – 125 VA, 24 to 277 VAC | | | |
| **Manual Reset** | | | |
| AC Full Load A | 16.0 | 9.2 | 8.0 |
| AC Locked Rotor A | 96.0 | 55.2 | 48.0 |
| Non-Inductive A | 16.0 | 9.2 | 8.0 |
| Pilot Duty – 125 VA, 24 to 600 VAC | | | |

1 SPST and N.O. contact of SPDT control.
SPDT N.C. contact- 16 amps 120 to 277 VAC

The performance specifications are nominal and conform to acceptable industry standards. For applications at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products. © 2009 Johnson Controls, Inc.

## Features

The 460's universal range from 190-480VAC, 50/60 Hz provides the versatility needed to handle global applications.

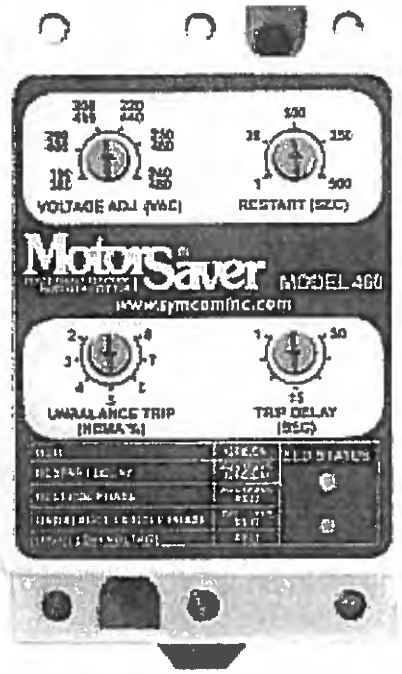
Four adjustment pots provide versatility for a variety of applications.

Diagnostic LEDs indicate trip status and provide simple troubleshooting.

Microcontroller-based circuitry provides better accuracy and higher reliability than analog designs.

Single-phase conditions are detected regardless of regenerated voltages.

Transient protection meets IEEE and IEC standards and permits operation under tough conditions.




# MotorSaver

## Model 460

### Three-Phase Voltage Monitor

•

### Engineered Protection

•

### Microcontroller Based

***Protects 3-Phase Motors from:***

- Loss of any phase
- Low voltage
- High voltage
- Voltage unbalance
- Phase reversal
- Rapid cycling

***Additional Features:***

- Compact design
- UL and cUL listed
- CE compliant
- Finger-safe terminals
- 5-year warranty
- Made in USA
- Standard surface or DIN rail mountable
- Standard 1-500 sec. variable restart delay
- Standard 2-8% variable voltage unbalance
- Standard 1-30 sec. variable trip delay
- One 10 amp general purpose Form C relay
- Optional manual reset

The **Model 460** is designed to protect 3-phase motors from damaging power conditions. The 460's wide operating range combined with UL and CE compliance enables quick access to domestic and global markets.

A unique microcontroller-based voltage and phase-sensing circuit constantly monitors the 3-phase voltages to detect harmful power line conditions. When a harmful condition is detected, the MotorSaver's output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level for a specified amount of time (restart delay). The trip delay prevents nuisance tripping due to rapidly fluctuating power line conditions.

The Model 460 automatically senses whether it is connected to a 190-240V, 60Hz system, a 440-480V, 60Hz system, or a 380-416V, 50Hz system. An adjustment is provided to set the nominal line voltage from 190-240 or 380-480VAC. Other adjustments include a 1-30 second trip delay, 1-500 second restart delay, and 2-8% voltage unbalance trip point.

SymCom Inc
Motor Protection & Controls Since 1974

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(800) 843-8848 • (605) 348-5580 • FAX (605) 348-5685
www.symcominc.com • email: sales@symcominc.com

10/05

MotorSaver®
THREE-PHASE ELECTRIC MOTOR PROTECTOR

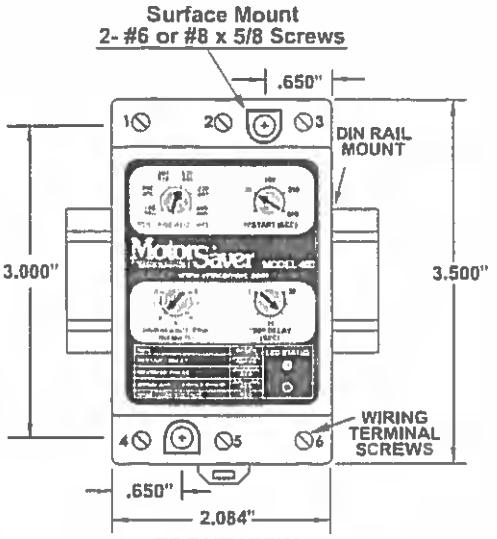
**Specifications**
•
**Operating Points**
•
**Special Options**

# Model 460
## Three-Phase Voltage Monitor

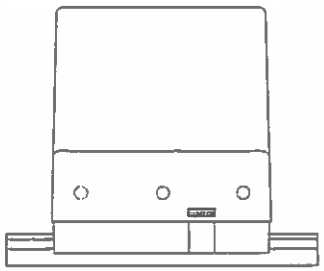
| | |
|---|---|
| **Specifications** | |
| **3-Phase Line Voltage** | 190-480VAC<br>(475-600VAC optional)<br>(95-120VAC optional) |
| **Frequency** | 50*/60Hz |
| **Low Voltage (% of setpoint)** | |
| •Trip | 90% ±1% |
| •Reset | 93% ±1% |
| **High Voltage (% of setpoint)** | |
| •Trip | 110% ±1% |
| •Reset | 107% ±1% |
| **Voltage Unbalance (NEMA)** | |
| •Trip | 2-8% adjustable |
| •Reset | Trip setting minus 1% (5 - 8%)<br>Trip setting minus .5% (2 - 4%) |
| **Trip Delay Time** | |
| •Low, High and Unbalanced Voltage | 1-30 seconds adjustable |
| •Single-Phasing Faults | 1 second fixed |
| **Restart Delay Time** | |
| •After a Fault | 1-500 seconds adjustable |
| •After a Complete Power Loss | 1-500 seconds adjustable |
| **Output Contact Rating** | |
| •1-Form C | 10A General Purpose @ 240VAC<br>Pilot Duty 480VA @ 240VAC, B300 |
| **Power Consumption** | 6 Watts (max.) |
| **Weight** | 14 oz |
| **Enclosure** | Polycarbonate |
| **Terminal Torque** | 6 in.-lbs. |
| **Wire Type** | Stranded or solid 12-20 AWG, one per terminal |
| **Safety Marks** | |
| •UL | UL508 |
| •CE | IEC 60947-6-2 |
| **Standards Passed** | |
| •Electrostatic Discharge (ESD) | IEC 1000-4-2, Level 3, 6kV contact, 8kV air |
| •Radio Frequency Immunity, Radiated | 150 MHz, 10V/m |
| •Fast Transient Burst | IEC 1000-4-4, Level 3, 3.5kV input power & controls |
| **Surge** | |
| •IEC | IEC 1000-4-5, Level 3, 4kV line-to line,<br>Level 4, 4kV line-to-ground |
| •ANSI/IEEE | C62.41 Surge and Ring Wave Compliance<br>to a level of 6kV line-to-line |
| •Hi-potential Test | Meets UL508 (2 x rated V +1000V for 1 minute) |
| **Environmental** | |
| Temperature Range | Ambient Operating: -20° to 70° C (-4° to 158°F)<br>Ambient Storage: -40° to 80° C (-40° to 176°F) |
| Class of Protection | IP20, NEMA 1 (FINGER SAFE) |
| Relative Humidity | 10-95%, non-condensing per IEC 68-2-3 |
| **Special Options** | |
| Manual Reset | External momentary pushbutton required |

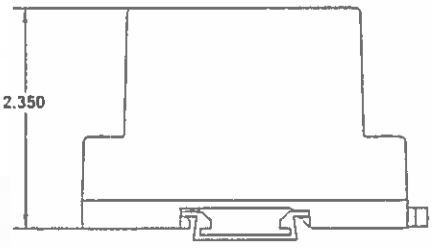
*Note: 50 Hz will increase all delay timers by 20%

SymCom warrants its microcontroller based products against defects in material or workmanship for a period of five (5) years from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, returns, and cancellations, please refer to the SymCom Terms and Conditions of Sale document.

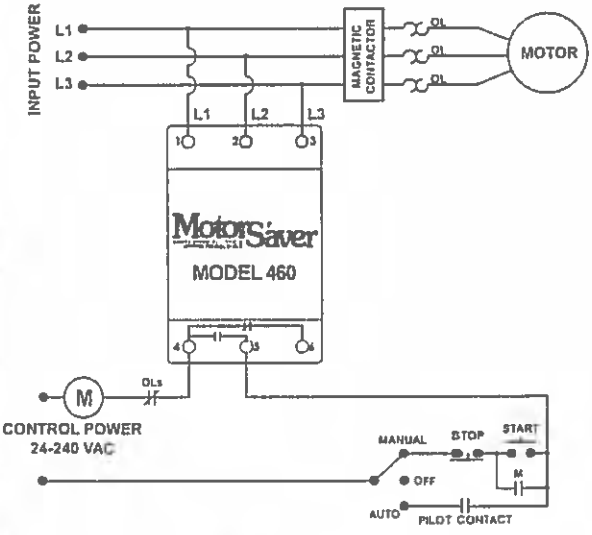


FRONT VIEW


BOTTOM VIEW



SIDE VIEW



TYPICAL WIRING DIAGRAM

SymCom Inc
Motor Protection & Controls Since 1974
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10/05

# *Manual Document List*

PMProjNum **RTS151**

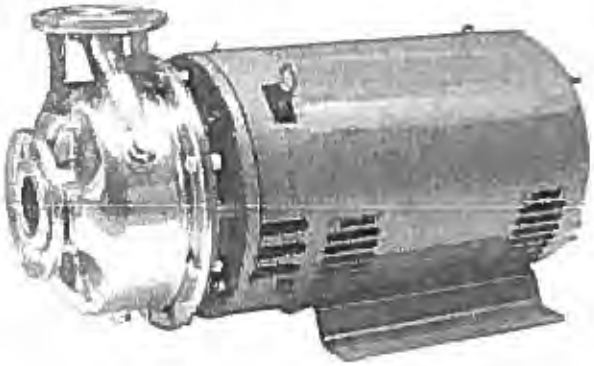
WTS, 150gpm, OWS-24, Carbon, 40' Container

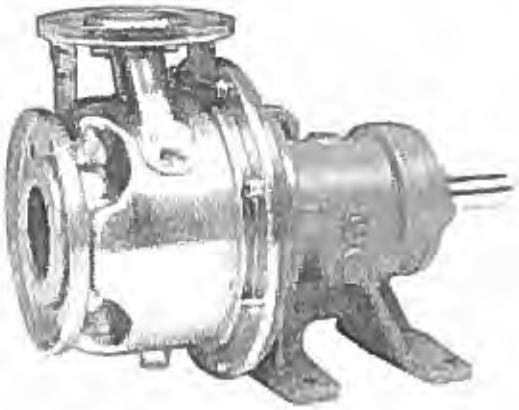
| Tag | Part Number | Part Description | | |
|---|---|---|---|---|
| Module: | | *4900* | | |
| P-4901 | 21028 | Pump, Suction, Goulds, SSH Series, 4SH2K | Manucturer: | Goulds |
| | | | ManDoc: | #N:\Library\Goulds\Manuals\Goulds_Pu |
| Module: | | *8200* | | |
| 8200 | 18396 | Motor Saver, 460 w/Diagnostic 3ph | Manucturer: | Symcom |
| | | | ManDoc: | N:\Library\Symcom\Manuals\Motor Sav |

G&L Pumps

# Installation, Operation and Maintenance Instructions

# Models SSH-C and SSH-F





## Owner's Information

Please fill in data from your pump nameplate.
Warranty information is on page 28.

Pump Model: _____

Serial Number: _____

Dealer: _____

Dealer's Phone Number: _____

Date of Purchase: _____

Installation Date: _____

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Goulds Pumps

ITT Industries

## SAFETY INSTRUCTIONS

**TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.**

**THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.**

This is a SAFETY ALERT SYMBOL. When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

**⚠ DANGER** Warns of hazards that WILL cause serious personal injury, death or major property damage.

**⚠WARNING** Warns of hazards that CAN cause serious personal injury, death or major property damage.

**⚠ CAUTION** Warns of hazards that CAN cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

**⚠WARNING**




UNIT NOT DESIGNED FOR USE WITH HAZARDOUS LIQUIDS OR FLAMMABLE GASES. THESE FLUIDS MAY BE PRESENT IN CONTAINMENT AREAS.

NOTICE: INSPECT UNIT FOR DAMAGE AND REPORT ALL DAMAGE TO THE CARRIER OR DEALER IMMEDIATELY.

## 1. Important Instructions

1. Inspect unit for damage. Report damage to carrier immediately.
2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

**⚠WARNING**




ALWAYS DISCONNECT ELECTRICAL POWER WHEN HANDLING PUMP OR CONTROLS.

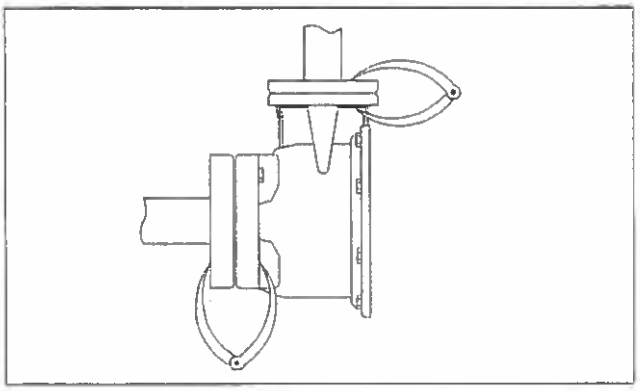
3. Motors must be wired for proper voltage (check nameplate). Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.
4. Single-Phase: Thermal protection for single-phase units is sometimes built-in (Check nameplate). If no built-in protection is provided, use a contactor with proper overload. Fusing is permissible if properly fused.
5. Three-Phase: Provide three-leg protection with proper size magnetic starter and thermal overloads.
6. Maximum Liquid Temperatures:
   212°F (100°C) with standard seal.
   250°F (120°C) with optional high-temperature seal.
7. Maximum allowable operating pressure: 230 PSI (15 bars).
8. Maximum number of starts per hour: 20, evenly distributed.
9. Regular Inspection and Maintenance will increase service life. Base schedule on operating time.

## 2. Installation

1. Close-coupled units may be installed inclined or vertical.

**⚠ CAUTION** DO NOT INSTALL WITH MOTOR BELOW PUMP. CONDENSATION WILL BUILD UP IN MOTOR.

2. Locate pump as near liquid source as possible (below level of liquid for automatic operation).
3. Protect from freezing or floods.
4. Allow adequate space for servicing and ventilation.
5. For close-coupled pumps, the foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration. Tighten motor hold-down bolts before connecting piping to pump.
6. For frame-mounted pumps, permanent and solid foundation is required for smooth operation. Bedplate must be grouted to a foundation with solid footing.
7. Place unit in position on wedges located at four points (Two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit, bringing coupling halves into reasonable alignment. Level or plumb suction and discharge flanges.
8. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming if necessary.
9. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before further tightening foundation bolts.
10. All piping must be supported independently of the pump, and must "line-up" naturally. Never draw piping into place by forcing the pump suction and discharge connections!
11. Angular alignment of the flanges can best be accomplished using calipers at bolt locations (See illustration).



12. On frame-mounted units, tighten foundation, pump and driver hold-down bolts before connecting piping to pump.
13. Avoid unnecessary fittings. Select sizes to keep friction losses low.
14. After completing piping, rotate unit by hand to check for binding. Note: A screwdriver slot or flats are provided in end of motor shaft.

## 3. Alignment

1. No field alignment is necessary on close-coupled pumps.
2. Even though the pump-motor unit may have a factory alignment, in transit this alignment could be disturbed and must be checked prior to running.
3. Check the tightness of all hold-down bolts before checking the alignment.
4. If re-alignment is necessary, always move the motor. Shim as required.
5. Final alignment is achieved when parallel and angular requirements are achieved with both pump and motor hold down bolts tight.

**⚠CAUTION** ALWAYS RECHECK BOTH ALIGNMENTS AFTER MAKING ADJUSTMENTS.

6. Parallel misalignment exists when the shafts are not concentric. Place dial indicator on one hub and rotate this hub 360° while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005" or less.
7. Angular misalignment exists when the shafts are not parallel. Place dial indicator on one hub and rotate this hub 360° while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005" or less.

## 4. Suction Piping

1. Low static lift and short, direct suction piping is desired. For suction lift over 15 feet, consult pump performance curve for *Net Positive Suction Head Required.*
2. Suction pipe size must be at least equal to suction connection of pump.
3. If larger pipe is used, an eccentric pipe reducer (with straight side up) must be used at the pump.
4. Installation with pump below source of supply:
   4.1. Install isolation valve in piping for inspection and maintenance.
   4.2. Do not use suction isolation valve to throttle pump!
5. Installation with pump above source of supply:
   5.1. To avoid air pockets, no part of piping should be higher than pump suction connection. Slope piping upwards from liquid source.
   5.2. All joints must be airtight.
   5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.
   5.4. Suction strainer open area must be at least triple the pipe area.
6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump.

## 5. Discharge Piping

1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or inspection of pump or check valve.
2. If reducer is required, place between check valve and pump.

## 6. Rotation

**⚠WARNING**




DO NOT PLACE HANDS IN PUMP WHILE CHECKING MOTOR ROTATION. TO DO SO WILL CAUSE SEVERE PERSONAL INJURY.

1. Pumps are right-hand rotation (Clockwise when viewed from the driver end). Switch power on and off. Observe shaft rotation. On frame-mounted units, check rotation before coupling pump to motor.
2. Single-Phase: Refer to wiring diagram on motor if rotation must be changed.
3. Three-Phase: Interchange any two power supply leads to change rotation.

## 7. Operation

1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

**⚠CAUTION** PUMPED LIQUID PROVIDES LUBRICATION. IF PUMP IS RUN DRY, ROTATING PARTS WILL SEIZE AND MECHANICAL SEAL WILL BE DAMAGED.

2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. Check coupling alignment.
3. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

## 8. Maintenance

**⚠WARNING**
Hazardous voltage

FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.

1. Bearings are located in and are part of the motor. For lubrication procedure, refer to manufacturer's instructions.
2. On frame-mounted units, regrease at 2,000 hours use or after 3 months. Use #2 Sodium or Lithium grease and fill until grease comes out of the relief fitting.

## 9. Disassembly

1. Always turn power off.
2. Drain system. Flush if necessary.
3. Remove motor hold-down bolts on close-coupled or disconnect coupling and remove spacer.
4. Remove casing bolts and pump hold-down bolts.
5. Remove motor and rotating element from casing.
6. Unscrew impeller bolt with a socket wrench. Do not insert screwdriver between impeller vanes to prevent rotation. It may be necessary to use a strap wrench around the impeller if impacting the socket wrench will not loosen the impeller bolt.
7. Remove impeller o-ring.
8. Insert two pry bars (180° apart) between impeller and seal housing. Pry off impeller.
9. Remove shaft sleeve, seal spring, cupwasher, seal rotary and impeller key.
10. Remove seal housing.
11. Place seal housing on flat surface. Press out stationary seal parts.
12. Remove deflector from shaft on frame-mounted units.
13. Remove bolts holding bearing cover to frame and remove bearing cover (frame-mount).
14. Remove lip seals from bearing frame and bearing cover (frame-mount).
15. Remove shaft and bearings from frame (frame-mount).
16. Remove bearing retaining ring (frame-mount).
17. Use bearing puller or arbor press to remove ball bearings (frame-mount).
18. Remove wear ring if excessively worn. Use pry bar and/or vicegrips.

## 10. Reassembly

1. All parts should be cleaned before assembly.
2. Refer to parts list to identify required replacement items.
3. Reassembly is the reverse of the disassembly procedure.
4. Replace lip seals if worn or damaged (frame-mount only).
5. Replace ball bearings if loose, rough or noisy when rotated (frame-mount only).
6. Check shaft for maximum runout of .005" TIR. Bearing seats and lip seal areas must be smooth and free of scratches or grooves. Replace if necessary (frame-mount only).
7. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.
8. If wear ring is being replaced, do not use lubricants on the metal-to-metal fit when pressing in the replacement.
9. If the impeller is removed, as for example to effect a mechanical seal change, this procedure must be followed: Old impeller bolt and impeller o-ring cannot be reused.
10. Install the mechanical seal stationary seat in the seal housing, using soapy water as a lubricant to ease insertion.
11. S-Group – Install the mechanical seal spring retainer, spring and rotary assembly on the shaft sleeve using soapy water to lubricate. Slide the shaft sleeve over the pump shaft, be sure that a new shaft sleeve o-ring is used.

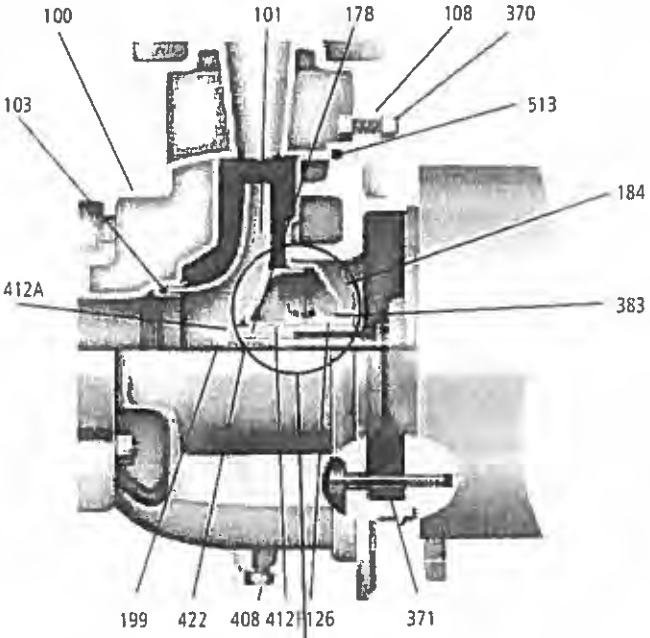
NOTE: THE SHAFT SLEEVE O-RING AND IMPELLER WASHER O-RING ARE ALMOST IDENTICAL IN DIAMETER. BE SURE TO USE THE SQUARE CROSS-SECTION O-RING IN THE IMPELLER WASHER. THE ROUND CROSS-SECTION O-RING IS USED IN THE SHAFT SLEEVE.

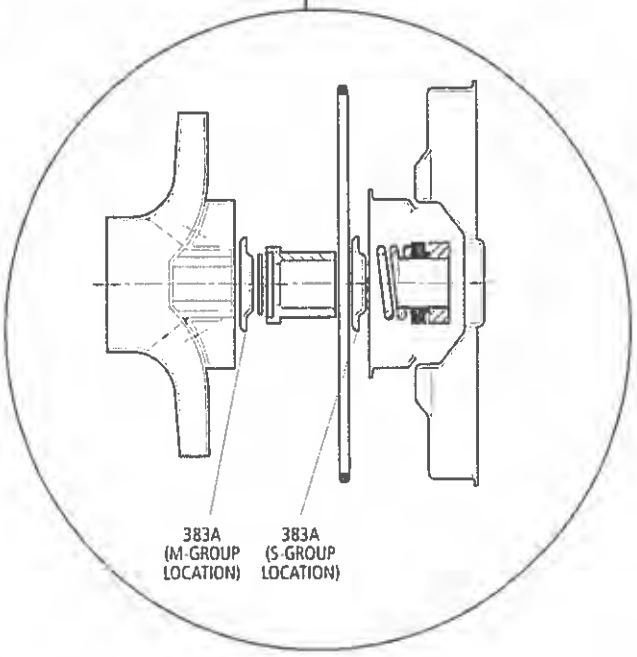
11. M-Group – Install the mechanical seal spring and rotary on the shaft sleeve using soapy water to lubricate. Slide the shaft sleeve over the pump shaft. Be sure that a new shaft sleeve o-ring is used. Place the mechanical seal spring retainer over the impeller hub.
12. Place the impeller key into the shaft keyway and slide the impeller in place. Install the impeller stud and impeller washer. Be sure that a new impeller o-ring is used. Tighten S-Group (⅜" thread) to 17 lb.ft. and M-Group (½" thread) to 38 lb.ft.

## 11. Troubleshooting

1. Motor does not start, and no noise or vibration occurs:
   1.1. Power supply not connected.
   1.2. Fuses or protection device tripped or defective.
   1.3. Loose or broken electrical connections.
2. Motor will not start, but generates noise and vibration:
   2.1. Motor not wired as directed on diagram.
   2.2. Shaft locked due to mechanical obstructions in motor or pump.
   2.3. Low voltage or phase loss on three phase supply.
3. Pump does not deliver rated capacity:
   3.1. Pump not filled and primed.
   3.2. Pump has lost prime due to leaks in suction line.
   3.3. Direction of rotation incorrect. See Rotation.
   3.4. Head required is higher than that originally specified. (Valve may be partially closed.)
   3.5. Foot valve clogged.
   3.6. Suction lift too high.
   3.7. Suction pipe diameter too small.
4. Protection trips as unit starts:
   4.1. Phase loss on three-phase supply.
   4.2. Protection device may be defective.
   4.3. Loose or broken electrical connections.
   4.4. Check motor resistance and insulation to ground.
5. Protection device trips too often:
   5.1. Protection may be set to a value lower than motor full load.
   5.2. Phase loss due to faulty contacts or supply cable.
   5.3. Liquid is viscous or its specific gravity is too high.
   5.4. Rubbing occurs between rotating and stationary parts.
6. Shaft spins with difficulty:
   6.1. Check for obstructions in the motor or the pump.
   6.2. Rubbing occurs between rotating and stationary parts.
   6.3. Check bearings for proper conditions.
7. Pump vibrates, runs noisily, and flow rate is uneven:
   7.1. Pump runs beyond rated capacity.
   7.2. Pump or piping not properly secured.
   7.3. Suction lift too high.
   7.4. Suction pipe diameter too small.
   7.5. Cavitation caused by insufficient liquid supply or excessive suction losses.
   7.6. Impeller blockage.
8. When stopped, unit turns slowly in the reverse direction:
   8.1. Leaks on air locks in suction pipe.
   8.2. Partial blockage in check valve.
9. In pressure boosting applications, the unit starts and stops too often:
   9.1. Pressure switch settings are incorrect.
   9.2. Tank size may be incorrect.
10. In pressure boosting applications, the unit does not stop:
    10.1. Pressure switch maximum setting is higher than was specified.
    10.2. Direction of rotation incorrect. See Rotation.

## SSH-C Components



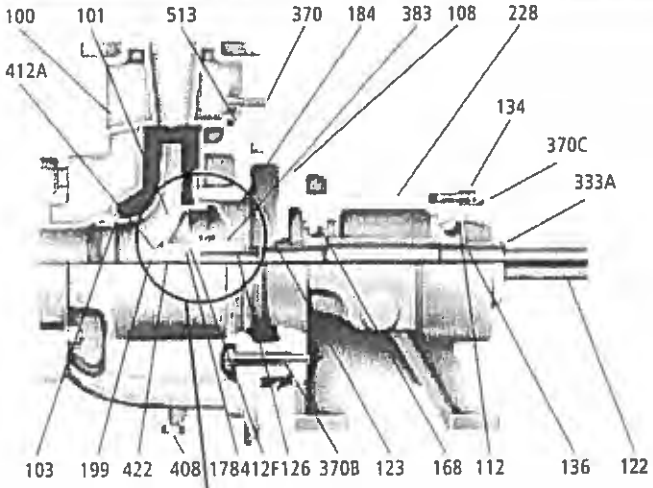

### MATERIALS OF CONSTRUCTION

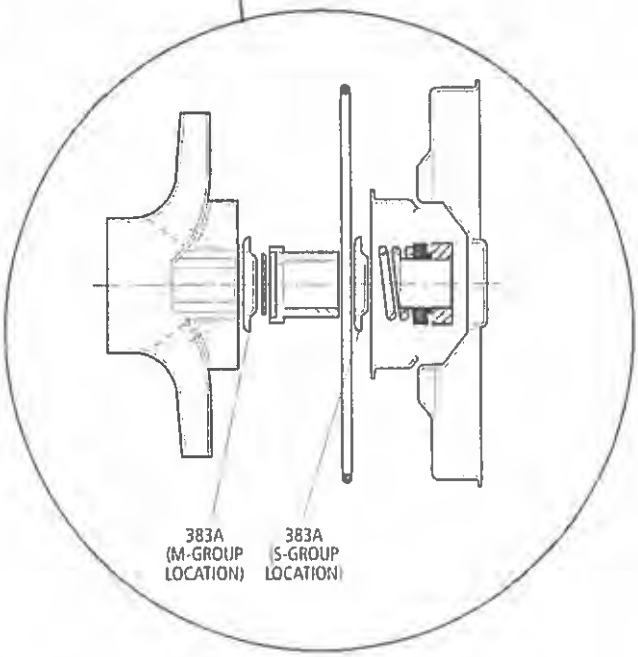
| Item | Description | Material |
|---|---|---|
| 100<br>101<br>103<br>184<br>370 | Casing<br>Impeller<br>Wear Ring<br>Seal Housing<br>Socket Head Cap Screw (Casing to Adapter) | AISI TYPE 316L Stainless Steel |
| 408 | Drain Plug — ¼ NPT | AISI TYPE 316 SS |
| 126 | Shaft Sleeve | 316 SS |
| 178 | Impeller Key | Steel |
| 422 | Impeller Stud | Steel |
| 199 | Impeller Washer | 316 SS |
| 108 | Adapter | Cast Iron ASTM A48CL20 |
| 371 | Hex Head Cap Screw (Adapter to Motor) | Steel |
| 412A | O-ring, impeller | BUNA-N |
| 412F | O ring, shaft sleeve | BUNA-N |
| 513 | O-Ring | BUNA-N |
| 383 | Mechanical Seal Part No. 10K13 | Carbon/Ceramic Buna Elastomers 316 SS Metal Parts |
| 383A | Spring Retainer | AISI Type 316 SS |

### OPTIONAL MECHANICAL SEALS

| John Crane Type 21 Mechanical Seals | | | | | | |
|---|---|---|---|---|---|---|
| Item | Part No. | Rotary | Stationary | Elastomers | Metal Parts | Intended Duty |
| 383 Options | 10K19 | Carbon | Ni-Resist | EPR | 316 SS | Hi-Temperature |
| | 10K25 | | Ni-Resist | Viton | | Chemical |
| | 10K27 | | Tungsten Carbide | EPR | | Hi-Temperature Mild Abrasive |

## SSH-F Components



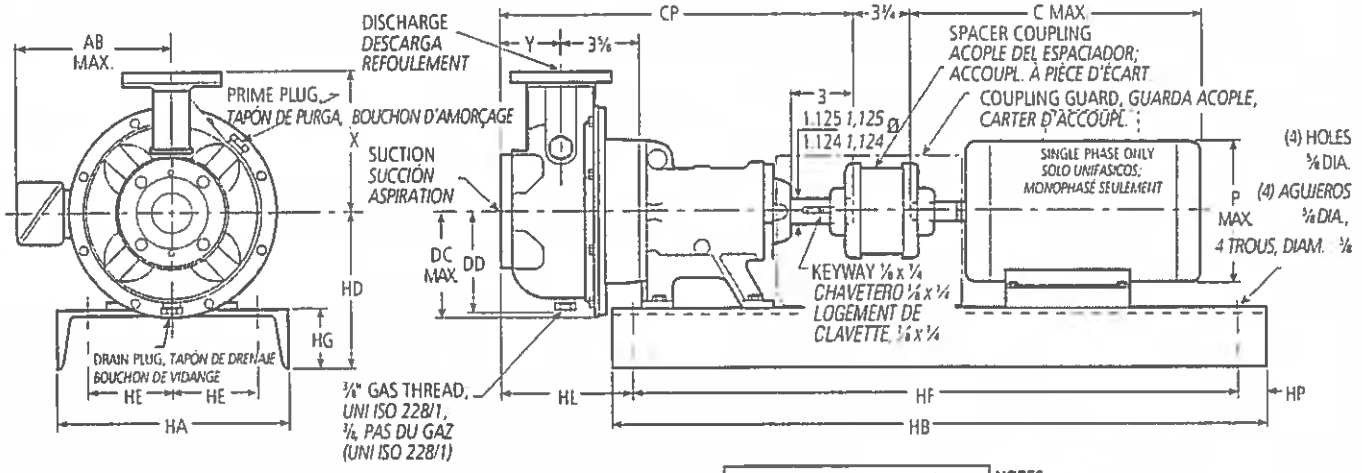

## MATERIALS OF CONSTRUCTION

| Item | | Description | Material |
|---|---|---|---|
| Pump End Components | 100<br>101<br>103<br>184<br>370 | Casing<br>Impeller<br>Wear Ring<br>Seal Housing<br>Socket Head Cap Screw | AISI TYPE 316L Stainless Steel |
| | 408 | Drain plug – ¼ NPT | AISI TYPE 316 SS |
| | 126 | Shaft Sleeve | 316 SS |
| | 178 | Impeller Key | Steel |
| | 422 | Impeller Stud | Steel |
| | 199 | Impeller Washer | 316 SS |
| | 412A | O-ring, impeller | BUNA-N |
| | 412F | O-ring, shaft sleeve | BUNA-N |
| | 513 | O-Ring | BUNA-N |
| | 383 | Mechanical Seal<br>Standard Part<br>No. 10K13 | Carbon/Ceramic<br>BUNA-N Elastomers<br>316 SS Metal Parts |
| | 383A | Spring Retainer | AISI Type 316SS |
| Power End Components | 108<br>228<br>134 | Adapter<br>Bearing Frame<br>Bearing Cover | Cast Iron ASTM A48 CL20 |
| | 122<br>168<br>112<br>136<br>370B<br><br>370C | Pump Shaft<br>Ball Bearing (Inboard)<br>Ball Bearing (Outboard)<br>Retaining Ring<br>Hex Head Cap Screw<br>(Adapter to Bearing Frame)<br>Hex Head Cap Screw<br>(Bearing Frame to Cover) | Steel |
| | 333A | Lip Seal | BUNA-N |
| | 193 | Grease Fitting | Steel |
| | 123 | V-Ring Deflector | BUNA-N |

## OPTIONAL MECHANICAL SEALS

| John Crane Type 21 Mechanical Seals | | | | | | |
|---|---|---|---|---|---|---|
| Item | Part No. | Rotary | Stationary | Elastomers | Metal Parts | Intended Duty |
| 383 Options | 10K19 | Carbon | Ni-Resist | EPR | 316 SS | Hi-Temperature |
| | 10K25 | | Ni-Resist | Viton | | Chemical |
| | 10K27 | | Tungsten Carbide | EPR | | Hi-Temperature Mild Abrasive |

**Channel Steel Bedplate, Clockwise Rotation Viewed from Drive End;**
***Fundación de Acero, Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor;***
***Plaque de base profilée en U et rotation en sens horaire (vue de l'extrémité du moteur)***




**Dimensions and Weights – Determined by Pump,**
***Dimensiones y Pesos – Determinados por la Bomba;***
***Dimensions et poids – pompe***

| Pump, *Bomba, Pompe* | | Suction ① *Succión ① Aspir.* | Discharge ① *Descarga ① Refoul.* | CP | DC Max., *DC Máx. DC max.* | DD | X | Y | Wt. (lbs.), *Peso (lib.) Poids* | Dimension "HL" Determined by Pump and Bedplate, *Dimensión "HL" determinada la bomba y el motor, Dimensions HL – pompe et plaque de base* Motor Frame Size, *Tamaño del bastidor del motor, Carcasse de moteur* 143/145 | 183/184 | 213/215 | 254/256 | 284/286 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9SH | 1 X 2–6 | 2 | 1 | 16¾ | 5 | 4¼ | 6¼ | 3¼ | 56 | 9⅛ | | 7⅛ | 3⅛ | |
| 10SH | 1 X 2–8 | | | | 5⅛ | 5⅛ | 7⅛ | | 64 | | | | | |
| 11SH | 1 X 2–10 | | | 17¼ | 6⅛ | 6⅛ | 8⅛ | | 86 | 10 | | 8½ | 4½ | |
| 4SH | 1½ X 2½–6 | 2½ | 1½ | 16½ | 5 | 4¼ | 6⅛ | 3¼ | 57 | 9¼ | | 7¼ | 4 | |
| 7SH | 1½ X 2½–8 | | | 17¼ | 5⅛ | 5⅛ | 7⅛ | 4 | 66 | 10 | | 8½ | 4¼ | |
| 5SH | 2 X 2½–6 | | 2 | | 5 | 4¼ | | | 57 | | | | | |
| 8SH | 2 X 2½–8 | | | | 6 | 5¼ | 7¹⁵⁄₁₆ | | 68 | | | | | |
| 6SH | 2½ X 3–6 | 3 | 2½ | | | | | | 59 | | | | | |

① For use with ANSI class 150 mating flanges.
*Para usar con bridas que casan ANSI clase 150.*
*À utiliser avec des contre-brides ANSI, classe 150.*

**NOTES:**
1 All pumps shipped in vertical discharge position. May be rotated in 90° increments. Tighten ⅛ – 16 casing bolts to 12 ft/lbs. torque.
2 Dimensions in inches.
3 Motor dimensions may vary with motor manufacturer.
4 Not to be used for construction purposes.

***NOTAS:***
*1 Todas las bombas transportadas en posición de descarga vertical. Pueden rotarse en aumentos de 90°. Apretar ⅛ – 16 tornillos de carcasa a 12 pies/libras potencia.*
*2 Las dimensiones en pulgadas.*
*3 Las dimensiones puede que varíen con los fabricantes.*
*4. No para propósitos de construcción.*

**NOTA :**
*1. L'orifice de refoulement est orienté vers le haut. On peut le tourner de 90° en 90°. Serrer les vis ⅛ - 16 du corps de pompe à 12 lbf pi*
*2. Les dimensions sont en pouces, et le poids en livres.*
*3. Les dimensions et le poids du moteur peuvent varier selon le fabricant.*
*4 Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.*

**Available Motor and Bedplate Dimensions and Weights,**
***Pesos y Dimensiones Disponibles de la Fundación y del Motor***
***Dimensions et poids – moteur et plaque de base***

| Motor Frame, *Armazón del Motor, Carcasse de moteur* | HP @ 3500 RPM, *HP a 3500 RPM, hp à 3 500 trimin* | | | | HP @ 1750 RPM, *HP a 1750 RPM, hp à 1 750 trimin* | | | | AB Max., *AB Máx., AB max.* | C Max., *C Máx., C max.* | P Max., *P Máx., P max.* | Wt. Max., *Peso Máx., Poids max.* | Bedplate Data, *Datos de la Fundación, Plaque de base* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Single Phase, *Monofásicos, 1 Ø* | | Three Phase, *Trifásicos, 3 Ø* | | Single Phase, *Monofásicos, 1 Ø* | | Three Phase, *Trifásicos, 3 Ø* | | | | | | HA | HB | HD* | HE | HF | HG | HP* | Wt. (lbs.), *Peso (libras), Poids* | Motor Shim, *Plancha de relleno del motor Cale de moteur* | Bearing Frame Shim *Plancha de relleno del bastidor del cojinete, Cale de palier* |
| | ODP | TEFC | ODP | TEFC | ODP | TEFC | ODP | TEFC | | | | | | | | | | | | | | |
| 143T | | | | | 1 | 1 | 1 | 1 | 5¼ | 13⅜ | 6⅛ | 45 | 10 | 28 | 8 | 3¾ | 24 | 2¾ | ¼ | 48 | 1¼ | – |
| 145T | 2 | 2 | 2 or ou 3 | 2 | 1½ | 1½ | 1½ or ou 2 | 1½ or ou 2 | | 14¼ | | 53 | | | | | | | | | | |
| 182T | 3 | 3 | 5 | 3 | 2 | 2 | 3 | 3 | 5⅛ | 16⅛ | 7⅛ | 74 | | | | | | | | | | |
| 184T | 5 | 5 | 7½ | 5 | 3 or ou 5 | 3 | 5 | 3 | | 18⅛ | | 95 | | | | | | | | | | |
| 213T | | | 10 | 7½ | | | | | 7⅛ | 18 | 9⅛ | 116 | 12 | 31 | 8¼ | 4¼ | 29 | 3 | 1 | 65 | – | – |
| 215T | | | 15 | 10 | | | | | | 19¼ | | 136 | | | | | | | | | | |
| 254T | | | 20 | 15 | | | | | 10⅛ | 21⅛ | 13 | 266 | 13 | 42 | 9¼ | 5¼ | 38½ | 4 | 1¼ | 110 | – | 1 |
| 256T | | | 25 | 20 | | | | | | 23⅛ | | 264 | | | | | | | | | | |
| 284TS | | | 30 | 25 | | | | | 12⅝ | 24¼ | 15 | 392 | 15 | 44 | 10½ | 5¼ | 40½ | 3½ | | 124 | – | 1¼ |
| 286TS | | | 40 | 30 | | | | | | 26¼ | | 432 | | | | | | | | | | |

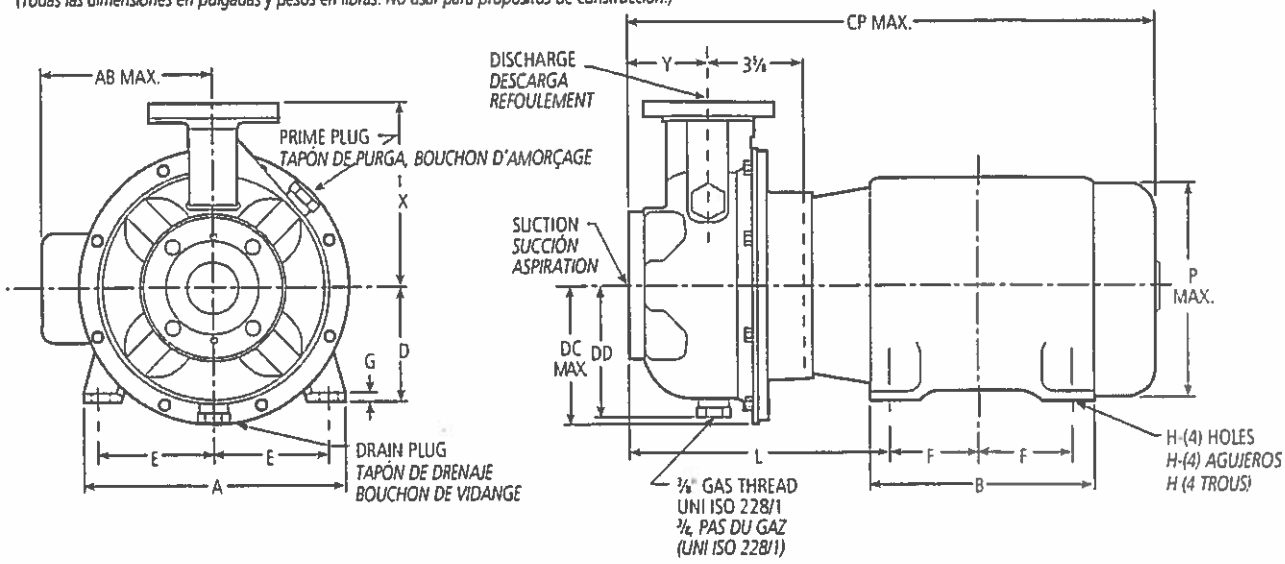
Dimensions and weights vary with manufacturers. Dimensions in inches and weights in lbs
"HP" Dimensions at motor end only.
* "HD" Dimension for 254T/256T motor frame on 1 x 2-10 only is 11", A ¾" motor shim and a 1¼" bearing frame shim are required.

*Dimensiones y pesos varían con los fabricantes. Dimensiones en pulgadas y pesos en libras*
*Dimensiones "HP" sólo en el extremo del motor.*
** La dimensión "HD" para el bastidor del motor 254T/256T de 1 x 2 - 10 es sólo 11", se requieren una cuña del motor de ¾" y una cuña del bastidor de apoyo de 1¼".*

*ODP = carcasse abritée (à ouvertures de ventilation protégées) , TEFC = carcasse fermée autoventilée*
**Dimensions HP à l'extrémité du moteur seulement. La dimension HD pour la carcasse 254T ou 256T, version 1X2-10 seulement est de 11 po ; une cale de moteur de ¾ po et une cale de palier de 1¼ po sont requises.*

## SSH S-Group Close Coupled – Dimensions and Weights, *SSH Acople Cerrado – Dimensiones y Pesos, Dimensions et poids – SSH montée sur moteur, groupe S*

(All dimensions in inches and weights in lbs. Do not use for construction purposes.)
*(Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)*




| Dimensions "L" Determined by Pump and Motor, *Dimensiones "L" Determinadas por la Bomba y el Motor, Dimensions L – pompe et moteur* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump, *Bomba, Pompe* | | 150 lb. Flange, *Brida de 150 lib., Bride, 150 lbfpo²* | | CP Max., *CP Máx., CP max.* | DC Max., *DC Máx., DC max.* | DD | X | Y | Motor Frame Size, *Tamaño del Armazón del Motor, Carcasse de moteur* | | | | Wt. (lbs.), *Pesos (libras), Poids* |
| | | Suct. ① *Succ. ① Aspir.* | Disch. ① *Desc. ① Refoul.* | | | | | | 143/145 | 182/184 | 213/215 | 254/256 | |
| 9SH | 1 x 2 – 6 | 2 | 1 | 25¾ | 5 | 4¼ | 6⅜ | 3⅛ | 9⅛ | 10¼ | 11¼ | — | 24 |
| 10SH | 1 x 2 – 8 | | | | 5⅜ | 5⅛ | 7⅛ | | | | | | 32 |
| 11SH | 1 x 2 – 10 | | | 27⅛ | 6¼ | 6⅜ | 8⅛ | 4 | 10½ | 11⅛ | 12⅛ | 12⅜ | 54 |
| 4SH | 1½ x 2½ – 6 | 2½ | 1½ | 25½ | 5 | 4¾ | 6⅛ | 3¼ | 9¼ | 10⅜ | 11⅜ | — | 25 |
| 7SH | 1½ x 2½ – 8 | | | 27⅞ | 5⅜ | 5⅛ | 7⅛ | 4 | 10½ | 11⅛ | 12⅛ | 12¾ | 34 |
| 5SH | 2 x 2½ – 6 | | 2 | | 5 | 4¼ | 6⅛ | | | | | | 25 |
| 8SH | 2 x 2½ – 8 | | | | 6 | 4¾ | 7 15/16 | | | | | | 36 |
| 6SH | 2½ x 3 – 6 | 3 | 2½ | | | | | | | | | | 27 |

① For use with ANSI class 150 mating flanges.
*Para usar con bridas que casan ANSI clase 150.*
*À utiliser avec des contre-brides ANSI, classe 150.*

**NOTE:**
1. Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten ¾ – 16 bolts to 12 ft./lbs., ⅞ – 14 bolts to 20 ft./lbs.
2. ALL dimensions in inches.
3. Motor dimensions may vary with motor manufacturer.
4. Not for construction purposes.

***NOTA:***
1. *Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posicion deseada, y apretar ¾ – 16 tornillos a 12 pies/libras, ⅞ – 14 tornillos a 20 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *Las dimensiones puede que varíen con los fabricantes.*
4. *No para propósitos de construcción.*

**NOTA :**
1. *L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis ¾ - 16 à 12 lbf pi et ⅞ - 14 à 20 lbf pi.*
2. *Les dimensions sont en pouces, et le poids, en livres.*
3. *Les dimensions et le poids du moteur peuvent varier selon le fabricant.*
4. *Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.*

### Dimensions Determined by JM Motor Frame, *Dimensiones Determinadas por el Armazón del Motor JM, Dimensions – carcasse de moteur JM*

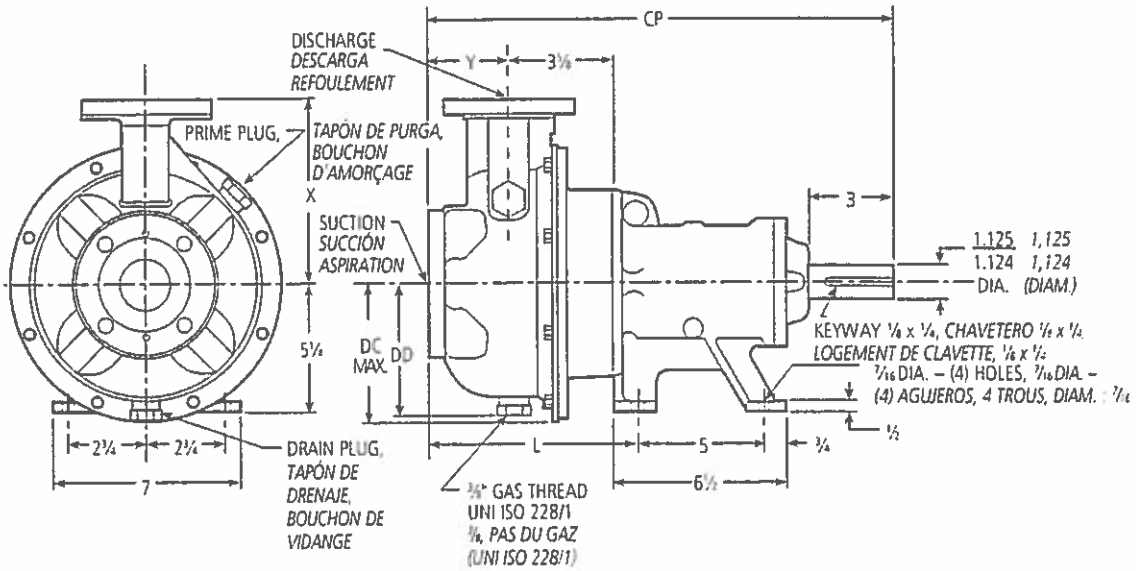
| JM Frame, *JM Armazón, Carcasse* | A | AB | B | D | E | F | G | H Dia., *H Diám., H (diam.)* | P Max., *P Máx., P max.* | Motor Wt. (lbs.) *Peso Motor (lib.), Poids du moteur* |
|---|---|---|---|---|---|---|---|---|---|---|
| 143JM | 6½ | 5¼ | 6 | 3½ | 2¾ | 2 | ⅛ | 11/32 | 6⅝ | 41 |
| 145JM | | | | | | 2½ | | | | 57 |
| 182JM | 8½ | 5⅛ | 6½ | 4½ | 3¾ | 2¼ | 3/16 | 13/32 | 7⅛ | 77 |
| 184JM | | | | | | 2¼ | | | | 97 |
| 213JM | 9½ | 7⅛ | 8 | 5¼ | 4¼ | 2¼ | 7/32 | | 9⅝ | 122 |
| 215JM | | | | | | 3½ | | | | 155 |
| 254TCZ | 11¼ | 9 | 9½ | 6¼ | 5 | 4⅛ | ¼ | 17/32 | 11½ | 265 |
| 256TCZ | | | 11¼ | | | 5 | | | | 320 |

### Motor Frame Selections, *Selecciones del Armazón del Motor, Choix de carcasses de moteur*

| Motor Frame, *Armazón del Motor, Carcasse* | Motor Horsepower, *Potencia del Motor, Puissance (hp)* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3500 RPM, *3500 RPM, 3 500 trimin* | | | | 1750 RPM, *1750 RPM, 1750 trimin* | | | |
| | 1Ø, *Monofásicos 1 Ø* | | 3Ø, *Trifásicos 3 Ø* | | 1Ø, *Monofásicos 1 Ø* | | 3Ø, *Trifásicos 3 Ø* | |
| | ODP | TEFC | ODP | TEFC | ODP | TEFC | ODP | TEFC |
| 143JM | – | – | – | – | – | – | 1 | 1 |
| 145JM | 2 | 2 | 2-3 | 2 | 1-1½ | 1-1½ | 1½-2 | 1½-2 |
| 182JM | 3 | 3 | 5 | 3 | 2 | 2-3 | 3 | 3 |
| 184JM | 5 | 5 | 7½ | 5 | 3 | – | 5 | 5 |
| 213JM | 7½ | – | 10 | 7½ | 5 | – | 7½ | 7½ |
| 215JM | 10 | – | 15 | 10-15 | – | – | – | – |
| 254TCZ | – | – | 20 | – | – | – | – | – |
| 256TCZ | – | – | 25 | 20-25 | – | – | – | – |

*ODP = carcasse abritée (à ouvertures de ventilation protégées),*
*TEFC = carcasse fermée autoventilée.*

## SSH S-Group Frame-Mounted – Dimensions and Weights, *SSH Armazón Montado – Dimensiones y Pesos, Dimensions et poids – SSH montée sur palier, groupe S*




**Dimensions and Weights – Bare Pump Only,**
***Dimensiones y Pesos – Solamente Bomba,***
***Dimensions et poids – pompe nue seulement***

| Pump, *Bomba, Pompe* | | 150 lb. Flange, *Brida de 150 lib., Bride, 150 lb/po²* | | DC Max., *DC Máx., DC max.* | DD | CP Max., *CP Máx., CP max.* | L | X | Y | Wt. (lbs.), *Peso (libras), Poids* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Suction ① *Succión ① Aspir.* | Discharge *Descarga ① Refoul.* | | | | | | | |
| 9SH | 1 x 2 – 6 | 2 | 1 | 5 | 4¾ | 16¾ | 7¾ | 6⅛ | 3¼ | 56 |
| 10SH | 1 x 2 – 8 | | | 5⅛ | 5⅛ | | | 7⅛ | | 64 |
| 11SH | 1 x 2 – 10 | | | 6⅛ | 6⅛ | 17¼ | 8½ | 8⅛ | 4 | 86 |
| 4SH | 1½ x 2½ – 6 | 2½ | 1½ | 5 | 4¾ | 16½ | 7¾ | 6⅛ | 3¼ | 56 |
| 7SH | 1½ x 2½ – 8 | | | 5⅛ | 5⅛ | 16½ | 8½ | 7⅛ | 4 | 64 |
| 5SH | 2 x 2½ – 6 | | 2 | 5 | 4¾ | | | | | 57 |
| 8SH | 2 x 2½ – 8 | | | 6 | 5¼ | | | 6⅛ | | 66 |
| 6SH | 2½ x 3 – 6 | 3 | 2½ | | | | | | | 57 |

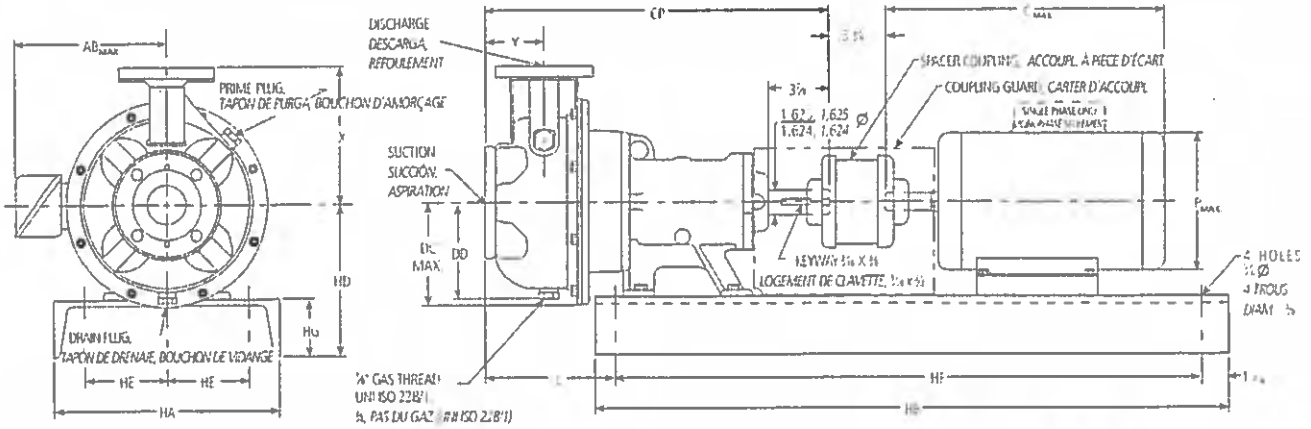
① For use with ANSI class 150 mating flanges.
*Para usar con bridas que casan ANSI clase 150.*
*À utiliser avec des contre-brides ANSI, classe 150.*

**NOTE:**
1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten ⅜ –16 bolts to 12 ft./lbs., 7/16 – 14 bolts to 20 ft./lbs.
2. ALL dimensions in inches.
3. Not for construction purposes.

***NOTA:***
1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras, 7/16 – 14 tornillos a 20 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *No para propósitos de construcción.*

***NOTA :***
1. *L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis ⅜ – 16 à 12 lbf·pi et 7/16 – 14 à 20 lbf·pi.*
2. *Les dimensions sont en pouces, et le poids, en livres.*
3. *Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.*

**Channel Steel Bedplate, Clockwise Rotation Viewed from Drive End;**
***Fundación de Acero, Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor;***
***Plaque de base profilée en U et rotation en sens horaire (vue de l'extrémité du moteur)***




**Dimensions and Weights – Determined by Pump,**
***Dimensiones y Pesos – Determinados por la Bomba,***
***Dimensions et poids – pompe***

| Pump, *Bomba, Pompe* | Pump Size, *Tamaño de la Bomba, Dimensions* | ① Suction *Succión Aspir.* | ① Discharge *Descarga Refoul.* | CP | DC Max., *DC Máx., DC max.* | DD | L | X | Y | Wt. (lbs.), *Peso (libras), Poids* |
|---|---|---|---|---|---|---|---|---|---|---|
| 24SH | 1½ x 2 ½-10 | 2½ | 1½ | 23 | 6⅞ | 6⅛ | 10⅛ | 8¹⁵⁄₁₆ | 4 | 125 |
| 25SH | 2 x 2½-10 | | 2 | | | | | | | 125 |
| 22SH | 2½ x 3-8 | 3 | 2½ | | 6⅛ | 5⅞ | | | | 125 |
| 27SH | 2½ x 3-10 | | | | 6⅞ | 6⅛ | | 9¹⁵⁄₁₆ | | 134 |
| 23SH | 3 x 4-8 | 4 | 3 | 24 | | | 11⅛ | | 5 | 136 |
| 28SH | 3 x 4-10 | | | | 7⅝ | 7⅛ | | 11⅛ | | 148 |

① For use with ANSI class 150 mating flanges.
*Para usar con bridas que casan ANSI clase 150.*
*À utiliser avec des contre-brides ANSI, classe 150.*

**NOTE:**
1 Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position and tighten ⅜ – 16 bolts to 12 ft./lbs.
2 ALL dimensions in inches.
3 Not for construction purposes.

***NOTA:***
*1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras.*
*2 TODAS las dimensiones en pulgadas.*
*3. No para propósitos de construcción*

**NOTA :**
*1. L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis ⅜ - 16 a 12 lbf·pi.*
*2. Les dimensions sont en pouces, et le poids, en livres.*
*3 Les dimensions et le poids du moteur peuvent varier selon le fabricant*
*4 Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.*

**Available Motor and Bedplate Dimensions and Weights,**
***Pesos y Dimensiones Disponibles de la Fundación y del Motor,***
***Dimensions et poids – moteur et plaque de base***

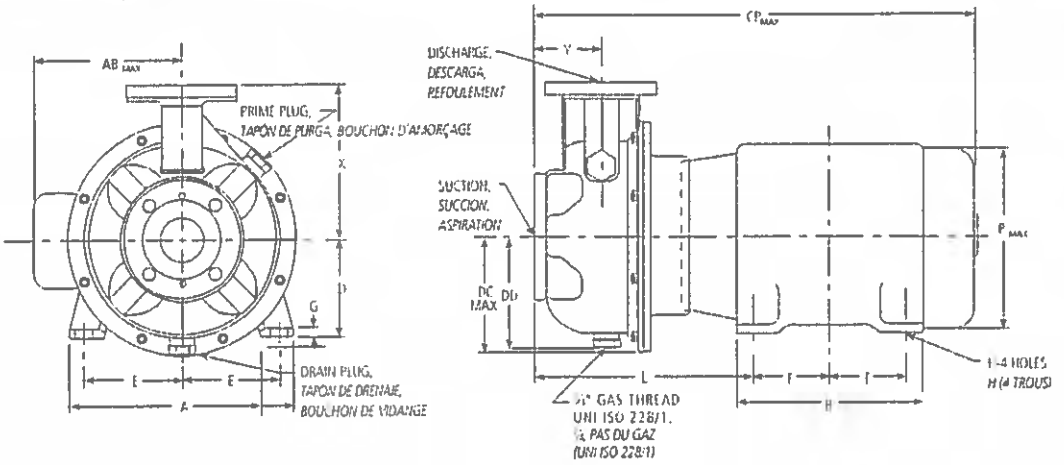
| Motor Frame, *Armazón del Motor, Carcasse de moteur* | HP @ 3500 RPM, *hp à 3 500 tr/min* | | HP @ 1750 RPM – T-Frame Only *hp à 1 750 tr/min – carc. T seulem.* | | | | AB Max., *AB Máx., AB max.* | C Max., *C Máx., C max.* | P Max., *P Máx., P max.* | Wt. Max., *Peso Máx., Poids max.* | Bedplate Data, *Datos de la Fundación, Plaque de base* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Three Phase, *Trifásicos, 3 Ø* | | Single Phase, *Monofásicos, 1 Ø* | | Three Phase, *Trifásicos, 3 Ø* | | | | | | HA | HB | HD | HE | HF | HG | Wt. (lbs.), *Peso (libras), Poids* |
| | ODP | TEFC | ODP | TEFC | ODP | TEFC | | | | | | | | | | | |
| 184T | | | 3 or ou 5 | 3 | 5 | 5 | 5⅞ | 18⅛ | 7⅛ | 95 | 13 | 42 | 10¼ | 5¼ | 38½ | 4 | 111 |
| 213T | | | | | 7½ | 7½ | 7⅜ | 18 | 9⅝ | 116 | | | | | | | |
| 215T | 15 | | | | 10 | 10 | | 19⅛ | | 136 | | | | | | | |
| 254T | 20 | 15 | | | 15 | 15 | 9½ | 21⅝ | 13 | 266 | | | | | | | |
| 256T | 25 | 20 | | | 20 | 20 | | 23⅜ | | 264 | | | | | | | |
| 284TS/T | 30 | 25 | | | 25 | 25 | 12⅝ | 24⅞ | 15 | 392 | 15 | 44 | 10½ | 5¾ | 40½ | 3½ | 124 |
| 286TS/T | 40 | 30 | | | | | | 26⅝ | | 422 | | | | | | | |
| 324TS/T | 50 | 40 | | | | | 14⅛ | 28¾ | 17⅜ | 592 | 18 | 48 | 12 | 7¼ | 44½ | 4 | 183 |
| 326TS/T | 60 | 50 | | | | | | 30¼ | | 634 | | | | | | | |
| 364TS/T | 75 | 60 | | | | | 15⅛ | 31⅝ | 18⅞ | 834 | | | 13 | | | | |
| 365TS/T | 100 | 75 | | | | | | 32⅝ | | 1000 | | | | | | | |
| 405TS/T | | 100 | | | | | 18 | 36¼ | 20½ | 1060 | 22 | 56 | 14 | 7¼ | 52½ | 4 | 214 |

Dimensions and weights vary with manufacturers. Dimensions in inches and weights in lbs
*Dimensiones y pesos varían con los fabricantes. Dimensiones en pulgadas y pesos en libras.*

*ODP = carcasse abritée (à ouvertures de ventilation protégées), TEFC = carcasse fermée autoventilée*

# SSH M-Group Close Coupled – Dimensions and Weights, *SSH Acople Cerrado – Dimensiones y Pesos, Dimensions et poids – SSH montée sur moteur, groupe M*

(All dimensions in inches and weights in lbs. Do not use for construction purposes.)
*(Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)*




| Dimensions "L" Determined by Pump and Motor, *Dimensiones "L" Determinadas por la Bomba y el Motor, Dimensions L – pompe et moteur* | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump, *Bomba, Pompe* | Pump Size, *Tamaño de la Bomba, Dimensions* | ① Suction *Succión Aspir.* | ① Discharge *Descarga Refoul.* | CP Max., *CP Máx., CP max.* | DC Max., *DC Máx., DC max.* | DD | X | Y | Wt. (lbs.), *Peso (libras), Poids* | Motor Frame Size, *Tamaño del Armazón del Motor, Carcasse de moteur* | | | | | | |
| | | | | | | | | | | 140 | 180 | 210 | 250 | 280 | 320 | 360 |
| 24SH | 1½ x 2 ½-10 | 2½ | 1½ | 34½ | 6⅞ | 6⅝ | 8 15/16 | 4 | 75 | 10½ | 11⅛ | 12⅛ | 13⅜ | | 14⅜ | - |
| 25SH | 2 x 2½-10 | | 2 | 36 | | | | | 75 | | | | | | | 15 |
| 22SH | 2½ x 3-8 | 3 | 2½ | | 6⅛ | 5⅞ | | | 72 | - | | | | | | |
| 27SH | 2½ x 3-10 | | | | 6⅞ | 6⅝ | 9 15/16 | | 84 | - | - | | | | | |
| 23SH | 3 x 4-8 | 4 | 3 | 37 | | | | 5 | 86 | 11½ | 12⅛ | 13⅜ | 14⅞ | | 15⅜ | 16 |
| 28SH | 3 x 4-10 | | | | 7⅛ | 7⅜ | 11⅛ | | 98 | | - | | | | | |

① For use with ANSI class 150 mating flanges
*Para usar con bridas que casan ANSI clase 150.*
*À utiliser avec des contre-brides ANSI, classe 150.*

**NOTES:**
1 Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten ⅜ – 16 bolts to 12 ft./lbs., ⅞ – 14 bolts to 20 ft./lbs., ½ – 13 bolts to 35 ft./lbs.
2 Motor dimensions may vary with motor manufacturer
3 Not for construction purposes.

***NOTAS:***
*1. Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras, ⅞ – 14 tornillos a 20 pies/libras, ½ – 13 tornillos a 35 pies/libras.*
*2. TODAS las dimensiones en pulgadas.*
*3 No para propósitos de construccion.*

**NOTA :**
*1 L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis ⅜ - 16 à 12 lbf·pi, ⅞ - 14 à 20 lbf·pi et ½ - 13 à 35 lbf·pi.*
*2. Les dimensions sont en pouces, et le poids, en livres.*
*3. Les dimensions et le poids du moteur peuvent varier selon le fabricant.*
*4. Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.*

## Dimensions Determined by JM Motor Frame, *Dimensiones Determinadas por el Armazón del Motor JM, Dimensions – carcasse de moteur JM*

| Frame, *Armazón, Carcasse* | A | AB Max., *AB max.* | B | D | E | F | G | H | P Max., *P Máx., P max.* |
|---|---|---|---|---|---|---|---|---|---|
| 145JM | 6½ | 5¼ | 6 | 3½ | 2¼ | 2½ | ⅛ | 11/32 | 7 5/16 |
| 182JM | 8½ | 5⅞ | 6½ | 4½ | 3¾ | 2¼ | 3/16 | 13/32 | 8½ |
| 184JM | | | | | | 2¾ | | | |
| 213JM | 9½ | 7⅜ | 8 | 5¼ | 4¼ | 3½ | 7/32 | | 10 3/16 |
| 215JM | | | | | | | | | |
| 254JM | 11¼ | 9 | 11¾ | 6¼ | 5 | 4⅛ | ¼ | 17/32 | 13¼ |
| 256JM | | | | | | 5 | | | |
| 284JM | 12¼ | 12¼ | 12¼ | 7 | 5½ | 4¾ | | | 15 |
| 286JM | | | | | | 5½ | | | |
| 324JM | 14 | 13¼ | 14 | 8 | 6¼ | 5½ | 5/16 | 21/32 | 16 5/16 |
| 326JM | | | | | | 5½ | | | |
| 364TCZ | 17¾ | 15½ | 15½ | 9 | 7 | 5⅝ | 1 | | 19 |
| 365TCZ | | | | | | 6⅛ | | | |

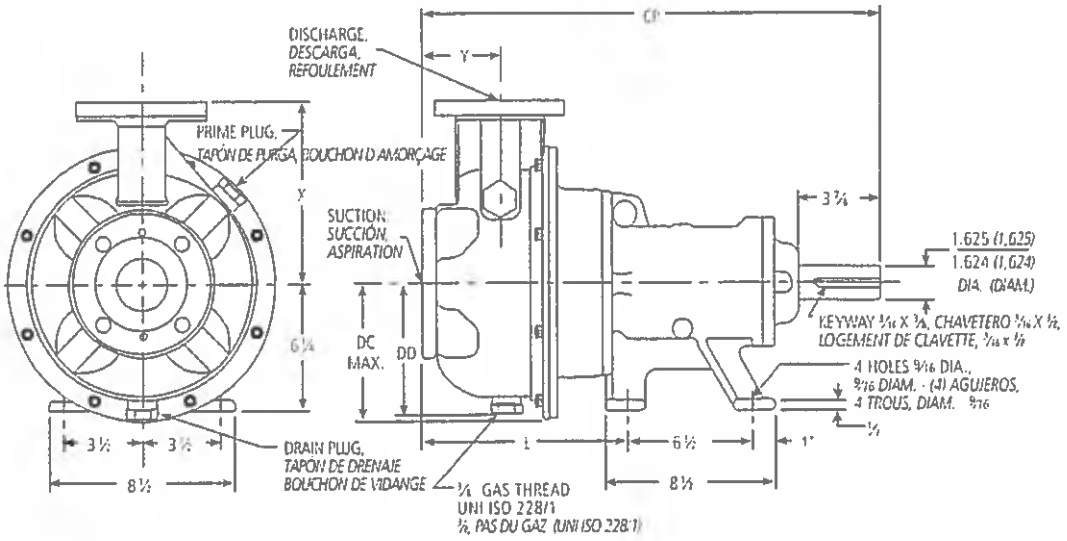
364TCZ and 365TCZ frames are built with 326JM shaft extensions
Dimensions may vary with manufacturer.;
*Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM.*
*Las dimensiones puede que varíen con los fabricantes.,*
*Les carcasses 364TCZ et 365TCZ possèdent la rallonge d'arbre de la 326JM*

## Motor Frame Selections, *Selecciones del Armazón del Motor, Choix de carcasses de moteur*

| Frame, *Armazón, Carcasse* | Motor Horsepower, *Potencia del Motor, Puissance (hp)* | | | | | | Wt. Max., *Peso Máx., Poids max.* |
|---|---|---|---|---|---|---|---|
| | 3500 RPM, *3500 r/min* | | 1750 RPM, *1750 r/min* | | | | |
| | 3 PH, *Trifásicos, 3 Ø* | | 1 PH, *Monofásicos, 1 Ø* | | 3 PH, *Trifásicos, 3Ø* | | |
| | ODP | TEFC | ODP | TEFC | ODP | TEFC | |
| 145JM | – | – | – | – | 2 | 2 | 57 |
| 182JM | – | – | 2 | 2, 3 | 3 | 3 | 77 |
| 184JM | – | – | 3 | – | 5 | 5 | 97 |
| 213JM | 10 | – | 5 | – | 7½ | 7½ | 141 |
| 215JM | 15 | 10 | – | – | 10 | 10 | 155 |
| 254JM | 20 | 15 | – | – | 15 | 15 | 265 |
| 256JM | 25 | 20 | – | – | 20 | 20 | 320 |
| 284JM | 30 | 25 | – | – | 25 | 25 | 419 |
| 286JM | 40 | 30 | – | – | – | – | 422 |
| 324JM | 50 | 40 | – | – | – | – | 562 |
| 326JM | 60 | 50 | – | – | – | – | 625 |
| 364TCZ | 75 | 60 | – | – | – | – | 775 |
| 365TCZ | 100 | 75 100 | – | – | – | – | 905 |

364TCZ and 365TCZ frames are built with 326JM shaft extensions
*Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM.*
*ODP = carcasse abritée (à ouvertures de ventilation protégées) ; TEFC = carcasse fermée autoventilee Les carcasses 364TCZ et 365TCZ possedent la rallonge d'arbre de la 326JM*

## SSH M-Group Frame Mounted – Dimensions and Weights, *SSH Armazón Montado – Dimensiones y Pesos, Dimensions et poids – SSH montée sur palier, groupe M*




**Dimensions and Weights – Bare Pump Only,**
***Dimensiones y Pesos – Solamente Bomba***
***Dimensions et poids – pompe nue seulement***

| Pump, *Bomba, Pompe* | Pump Size, *Tamaño de la Bomba, Dimensions* | ① Suction *Succión Aspir.* | ① Discharge *Descarga Refoul.* | CP | DC Max., *DC Máx., DC max.* | DD | L | X | Y | Wt. (lbs.), *Peso (libras), Poids* |
|---|---|---|---|---|---|---|---|---|---|---|
| 24SH | 1½ x 2 ½-10 | 2½ | 1½ | 23 | 6⅞ | 6⅝ | 10½ | 8 15/16 | 4 | 125 |
| 25SH | 2 x 2½-10 | | 2 | | | | | | | 125 |
| 22SH | 2½ x 3-8 | 3 | 2½ | | 6⅛ | 5⅞ | | | | 125 |
| 27SH | 2½ x 3-10 | | | | | | | | | 134 |
| 23SH | 3 x 4-8 | 4 | 3 | 24 | 6⅜ | 6½ | 11½ | 9 15/16 | 5 | 136 |
| 28SH | 3 x 4-10 | | | | 7⅛ | 7⅜ | | 11⅛ | | 148 |

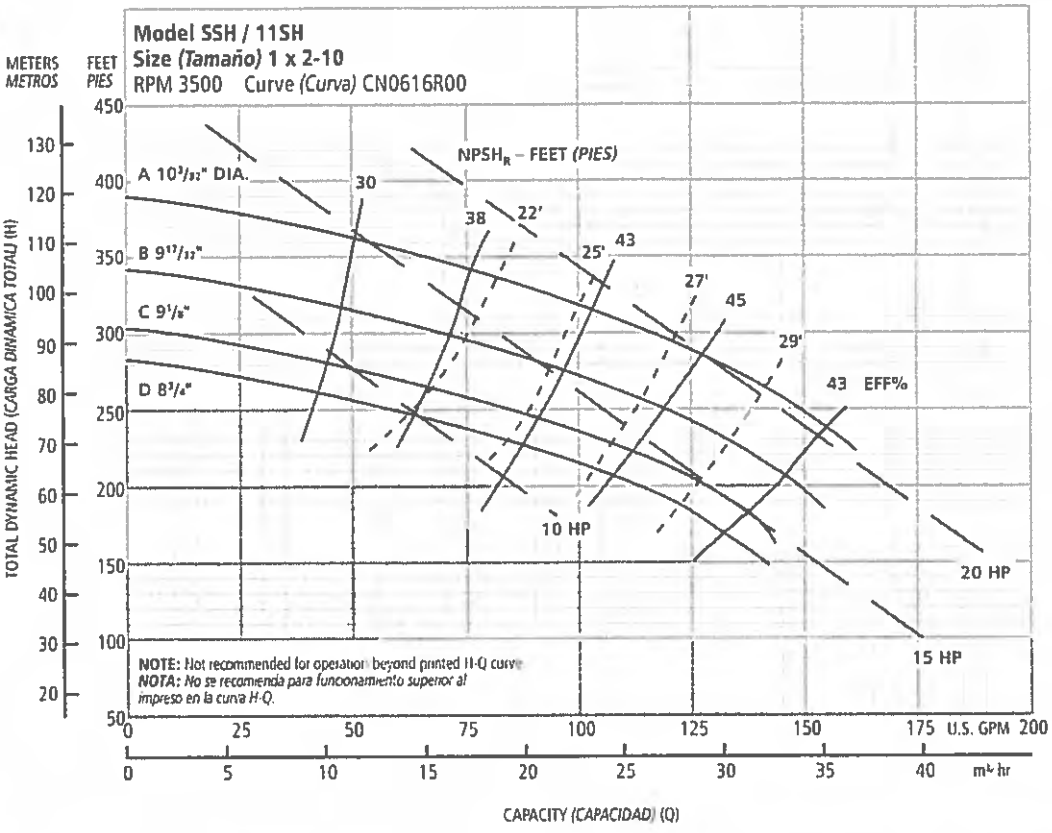
① For use with ANSI class 150 mating flanges.
*Para usar con bridas que casan ANSI clase 150.*
*À utiliser avec des contre-brides ANSI, classe 150.*

NOTES:
1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten ⅜–16 bolts to 12 ft./lbs.
2. Motor dimensions may vary with motor manufacturer.
3. Not for construction purposes.

*NOTAS:*
1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar ⅜ – 16 tornillos a 12 pies/libras.*
2. *TODAS las dimensiones en pulgadas.*
3. *No para propósitos de construcción.*

NOTA :
1. *L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis ⅜ – 16 à 12 lbf pi.*
2. *Les dimensions sont en pouces, et le poids, en livres.*
3. *Les dimensions et le poids du moteur peuvent varier selon le fabricant.*
4. *Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.*

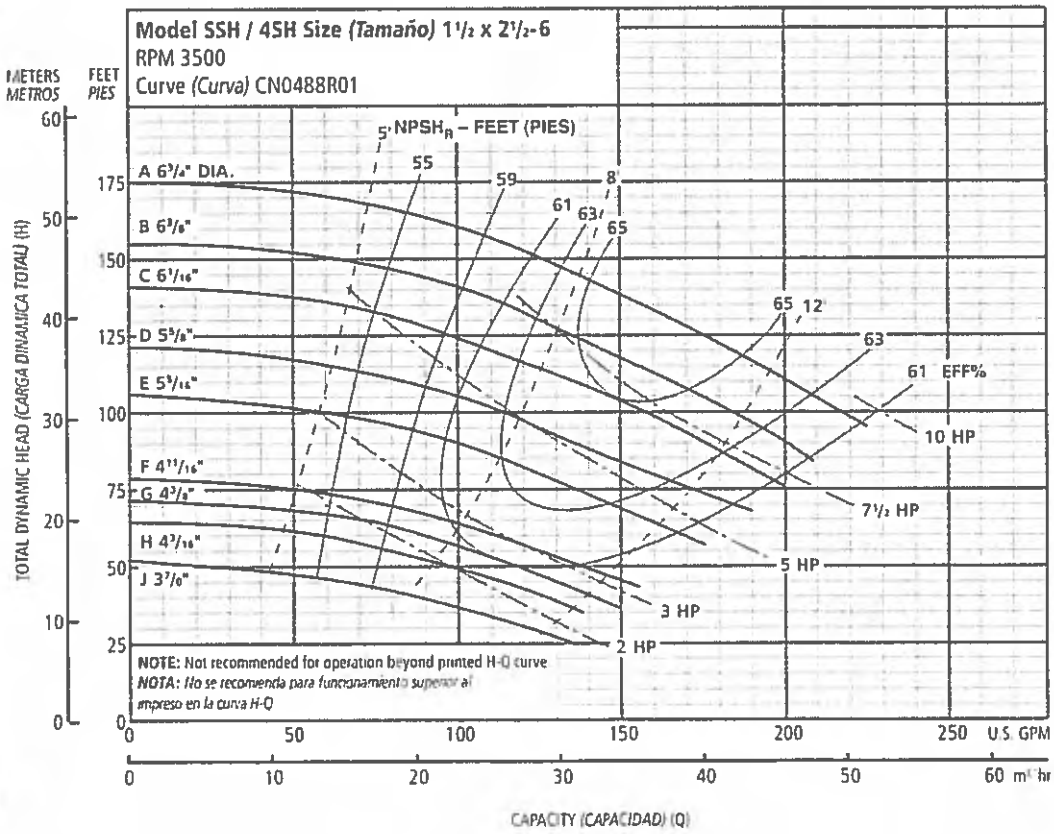
## Performance Curves – 60 Hz, 3500 RPM
## *Curvas de Funcionamiento – 60 Hz, 3500 RPM*




| Optional Impeller, *Impulsor Opcional* | | |
|---|---|---|
| Impeller Code, *Código del Impulsor* | Dia., *Diá.* | Standard HP Rating, *Estándar HP Potencia* |
| A | 10 3/32" | 20 |
| B | 9 17/32" | 15 |
| C | 9 1/8" | 15 |
| D | 8 3/4 | 15 |

**NOTE:** Pump will pass a sphere to ¼" diameter.

*NOTA: La bomba pasará una esfera a ¼" diámetro.*




| Optional Impeller, *Impulsor Opcional* | | |
|---|---|---|
| Impeller Code, *Código del Impulsor* | Dia., *Diá.* | Standard HP Rating, *Estándar HP Potencia* |
| A | 6¾" | 10 |
| B | 6⅜ | 7½ |
| C | 6 1/16 | 7½ |
| D | 5⅝ | 5 |
| E | 5 5/16 | 5 |
| F | 4 11/16 | 3 |
| G | 4⅜ | 3 |
| H | 4 3/16 | 2 |
| J | 3⅞ | 2 |

**NOTE:** Pump will pass a sphere to 3/16" diameter.

*NOTA: La bomba pasará una esfera a 3/16" diámetro.*

GOULDS PUMPS

# Wastewater Pumps
## Dewatering, Effluent and Sewage
*Installation and Operation Manual*

### Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Control Model Number: _____

Dealer: _____

Dealer Phone No. _____

Date of Purchase: _____ Installation: _____

Current Readings at Startup:

| 1Ø | 3Ø | L1-2 | L2-3 | L3-1 |
|---|---|---|---|---|
| Amps: _____ | Amps: _____ | _____ | _____ | _____ |
| Volts: _____ | Volts: _____ | _____ | _____ | _____ |

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Goulds Pumps

ITT Industries

## SAFETY INSTRUCTIONS

**TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.**

**THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.**

This is a SAFETY ALERT SYMBOL. When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

**⚠ DANGER** Warns of hazards that WILL cause serious personal injury, death or major property damage.

**⚠ WARNING** Warns of hazards that CAN cause serious personal injury, death or major property damage.

**⚠ CAUTION** Warns of hazards that CAN cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

**⚠ WARNING** All electrical work must be performed by a qualified technician. Always follow the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void manufacturer's warranty.

**⚠ WARNING** Standard units are not designed for use in swimming pools, open bodies of water, hazardous liquids, or where flammable gases exist. These fluids and gases may be present in containment areas. Tank or wetwell must be vented per local codes.

Only pumps specifically Listed for Class 1, Division 1 are allowable in hazardous liquids and where flammable gases may exist. *See specific pump catalog bulletins or pump nameplate for all agency Listings.*

**⚠ WARNING** Disconnect and lockout electrical power before installing or servicing any electrical equipment. Many pumps are equipped with automatic thermal overload protection which may allow an overheated pump to restart unexpectedly.

**⚠ CAUTION** All three phase (3Ø) control panels for submersible pumps must provide Class 10, quick-trip, overload protection.

## PRE-INSTALLATION CHECKS

Open all cartons and inspect for shipping damage. Report any damage to your supplier or shipping carrier immediately.

Important: Always verify that the pump nameplate Amps, Voltage, Phase, and HP ratings match your control panel and power supply.

Many of our sewage pumps are oil-filled. If there are any signs of oil leakage or if the unit has been stored for an extended period check the oil level in the motor dome and the seal housing, if so equipped.

Check the motor cover oil level through the pipe plug on top of the unit. The motor chamber oil should just cover the motor. Do not overfill, leave room for expansion!

To check the seal housing oil level, where used, lay the unit on its side with the fill plug at 12 o'clock. Remove the plug. The oil should be within ½" (13mm) of the top. If low, refill with an ASTM 150 turbine oil. Replace the plug.

Oil is available in 5 gallon cans through our distributors. You can also source oil locally at motor repair shops. Typical oil brands are: Shell Turbo 32, Sunoco Sunvis 932, Texaco Regal R&O 32, Exxon Nuto 32 and Mobil DTE Light.

Check the strain relief nut on power cable strain assemblies. Power cables should be torqued to 75 in. lbs. for #16 cables and 80 in. lbs. for all other cable assemblies. Seal/heat sensor cables, where used, should be torqued to 75 in. lbs.

Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (voltage/phase supply).

Record the model numbers and serial numbers from the pumps and control panel on the front of this instruction manual for future reference. Give it to the owner or affix it to the control panel when finished with the installation.

## LIFTING OF PUMP

**⚠ WARNING**




DO NOT LIFT, CARRY OR HANG PUMP BY THE ELECTRICAL CABLES. DAMAGE TO THE ELECTRICAL CABLES CAN CAUSE SHOCK, BURNS OR DEATH.

Lift the pump with an adequately sized chain or cable attached to the lifting eye bolt. DO NOT damage electrical and sensor cables while raising and lowering unit.

## OPTIONAL GUIDE RAIL OR LIFT-OUT SYSTEM

In many effluent and sewage basins or lift stations it is advisable to install the pump on a guide rail system or on a lift-out adapter to facilitate installation and removal for inspection and/or service. Most codes do not allow personnel to enter a wetwell without the correct protective equipment and training. Guide rails are designed to allow easy removal of the pump without the need for entry into the wetwell or need to disturb piping. The guide rail or lift-out adapter should locate the pump opposite the influent

opening preventing stagnate areas where solids can settle. The basin or pit must be capable of supporting the weight of the pump and guide rail. The pit floor must be flat.

NOTICE: FOLLOW THE INSTRUCTIONS THAT ARE PROVIDED WITH THE GUIDE RAIL ASSEMBLY.

## PIPING

Discharge piping should be no smaller than the pump discharge diameter and kept as short as possible, avoiding unnecessary fittings to minimize friction losses.

Install an adequately sized check valve matched to the solids handling capability of the pump to prevent fluid backflow. Backflow can allow the pump to "turbine" backwards and may cause premature seal and/or bearing wear. If the pump is turning backwards when it is called on to start the increased torque may cause damage to the pump motor and/or motor shaft and some single-phase pumps may actually run backwards.

Install an adequately sized gate valve AFTER the check valve for pump, plumbing and check valve maintenance.

**Important – Before pump installation.** Drill a 7/16" (4.8mm) relief hole in the discharge pipe. It should be located within the wetwell, 2" (51mm) above the pump discharge but below the check valve. The relief hole allows any air to escape from the casing. Allowing liquid into the casing will insure that the pump can start when the liquid level rises. Unless a relief hole is provided, a bottom intake pump could "air lock" and will not pump water even though the impeller turns.

All piping must be adequately supported, so as not to impart any piping strain or loads on the pump.

The pit access cover must be of sufficient size to allow for inspection, maintenance and crane or hoist service.

## WIRING AND GROUNDING

*Important notice: Read Safety Instructions before proceeding with any wiring.*

⚠ Use only stranded copper wire to pump/motor and ground. The ground wire must be at least as large as the power supply wires. Wires should be color coded for ease of maintenance and troubleshooting.

⚠ Install wire and ground according to the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes.

⚠ Install an all leg disconnect switch where required by code.

⚠ Disconnect and lockout electrical power before performing any service or installation.

⚠ The electrical supply voltage and phase must match all equipment requirements. Incorrect voltage or phase can cause fire, motor and control damage, and voids the warranty.

⚠ All splices must be waterproof. If using splice kits follow manufacturer's instructions.

**⚠ WARNING** Select the correct type and NEMA grade junction box for the application and location. The junction box must insure dry, safe wiring connections.

**⚠ WARNING** Seal all controls from gases present which may damage electrical components.

**⚠ WARNING** Hazardous voltage

FAILURE TO PERMANENTLY GROUND THE PUMP, MOTOR AND CONTROLS BEFORE CONNECTING TO POWER CAN CAUSE SHOCK, BURNS OR DEATH.

## SELECTING AND WIRING PUMP CONTROL PANELS AND SWITCHES

### FLOAT SWITCH TYPES

There are two basic float switch designs; single-action and wide-angle. Single-action switches operate over a range of 15° so they open and close quickly. Wide-angle floats operate over a 90° swing with the tether length between the float body and the pivot point controlling the On-Off range. The design determines how many floats are required with different systems or controls.

Floats may be normally open (NO) for pump down applications or to empty a tank. Normally closed (NC) switches are used to pump up or to fill a tank.

A single-action control switch may be used only with a control panel, never direct connected to a pump.

The wide-angle, pump down switches may be used as direct connected pump switches or as control switches.

### SETTING THE FLOAT SWITCHES

There are no absolute rules for where to set the float switches, it varies from job to job.

**Suggested Rules to Follow:**
**All floats should be set below the Inlet pipe!**

**Off Float: Best:** set so the water level is always above the top of the pump (motor dome). **Next Best:** set so the water level is not more than 6" below the top of the pump.

**On Float:** set so the volume of water between the On and Off floats allows pumps of 1½ HP and under to operate for 1 minute minimum. Two (2) HP and larger pumps should run a minimum of 2 minutes. Basin literature states the gallons of storage per inch of basin height.

**Lag/Alarm Float(s):** should be staggered above the Off and On floats. Try to use most of the available storage provided by the basin, save some space for reserve storage capacity. *See Diagrams and Charts in Float Switch Chart Section.*

### PANEL WIRING DIAGRAMS

Our control panels are shipped with instructions and wiring diagrams. Use those instructions in conjunction with this IOM. Electrical installation should be performed only by qualified technicians. Any problem or questions pertaining to another brand control must be referred to that control supplier or manufacturer. Our technical people have no technical schematics or trouble shooting information for other companies' controls.

### ALARMS

We recommend the installation of an alarm on all Wastewater pump installations. Many standard control panels come equipped with alarm circuits. If a control panel is not used, a stand alone high liquid level alarm is available. The alarm alerts the owner of a high liquid level in the system so they can contact the appropriate service personnel to investigate the situation.

## SINGLE PHASE PUMPS

Single phase (1Ø) pumps may be operated using a piggyback or hard wired float switch, a contactor, or a Simplex or Duplex control panel. *See Figures 1, 2 and 5.*

All 1/3 and 1/2 HP, 115 or 230 volt pumps, and some 3/4 and 1 HP pumps, are supplied with plug style power cords. They may be plugged into piggyback float switches for simple installations. It is allowable to remove the plugs in order to hardwire or connect to a Simplex or Duplex controller. Removing the plug neither voids the warranty nor violates the agency Listings. *See Figure 5.*




PLUG-CONNECTED UNITS MUST BE CONNECTED TO A PROPERLY GROUNDED, GROUNDING TYPE RECEPTACLE.

ON NON-PLUG UNITS, DO NOT REMOVE CORD AND STRAIN RELIEF. DO NOT CONNECT CONDUIT TO PUMP.

Pumps with bare lead power cords can be hard-wired to a float switch, wired to a 1O contactor, a Simplex controller or a Duplex controller. Always verify that the float switch is rated for the maximum run amperage, maximum starting amperage, and the HP rating on the pump. Single-phase wastewater pumps contain on-winding overloads, unless noted on the pump nameplate. *See Figures 1 and 2.*

## THREE PHASE PUMPS:

As a Minimum a 3Ø pump requires a 3 pole circuit breaker/fused circuit, an across the line magnetic starter rated for the pump HP, and ambient compensated Quick Trip Class 10 overloads.

## SINGLE AND THREE PHASE CONTROL PANELS:

Control panels are available as Simplex (controls 1 pump) or Duplex (controls 2 pumps). Our standard SES Series Panels are available with many standard features and can be built with our most popular options. We also custom build panels which offer many more design options than the SES panels. Custom control panels are available in many different configurations. Custom panel quote requests may be forwarded to Customer Service through any authorized distributor.

Our "SES" Duplex panels feature a solid-state printed circuit board design with standard high level alarm circuits. Other standard features are: an auxiliary dry alarm contact for signaling a remote alarm and float switch position indicator lights. Our 3Ø panels have built-in, adjustable, Class 10 overloads. The adjustable overloads on all our 3Ø panels mean less labor for the installer and no need to order specific overloads. Most SES panels are in stock for immediate delivery.

On pumps equipped with seal fail and/or heat (high temperature) sensors it is recommended that you use our control panel with the appropriate options. The pump sensors do not function without a seal fail relay or terminal connection in the control panel and a warning device such as a bell, horn or light.

Seal Failure Circuit - Some dual seal pumps are equipped with a standard, built-in seal failure circuit, which may also be called a moisture detection circuit. This circuit must be connected to a control panel with an optional seal fail relay. The panel must be special ordered with the seal fail relay and alarm. There are also stand alone seal fail panels such as the A4-3 or A4-4 available as standard items. The pumps can be identified by an extra control cable exiting the motor cover. The cable contains two wires, a black wire, connects to panel "terminal" going to "probe"; and a white wire, connects to the panel "terminal" going to the relay ground. Do not connect to the panel ground screw. Follow the wiring instructions supplied with the panel.

Heat Sensor and Seal Failure Circuit - Some pumps are equipped with a seal fail and normally closed, on-winding high temperature thermostats (heat sensors). The pumps have a control cable with four (4) leads, black (probe) and green (relay ground) for the seal fail circuit and red and white for the high temperature circuit. Connect the high temperature (heat sensor) circuit to the panel terminal strip as indicated on the panel drawing using the red and white wires. The high temperature panel circuit is also an optional item which you must specifically order when you order your control panel. The high temperature circuit is different from the Class 10 overloads which are always required on three phase pumps. *Follow the wiring instructions supplied with the panel.*

## INSTALLATION

Connect the pump(s) to the guide rail pump adapters or to the discharge piping. Slide rail bases should be anchored to the wetwell floor.

Complete all wiring per the control panel wiring diagrams and NEC, Canadian, state, provincial and/or local codes. This a good time to check for proper rotation of the motors/impellers.




DO NOT PLACE HANDS IN PUMP SUCTION WHILE CHECKING MOTOR ROTATION. TO DO SO WILL CAUSE SEVERE PERSONAL INJURY.

Always verify correct rotation. Correct rotation is indicated on the pump casing. Three phase motors are reversible. It is allowable to bump or jog the motor for a few seconds to check impeller rotation. It is easier to check rotation before installing the pump. Switch any two power leads to reverse rotation.

Lower the pump(s) into the wetwell.

Check to insure that the floats will operate freely and not contact the piping.

## OPERATION

Once the piping connections are made and checked you can run the pumps.

Piggyback Switch Operation – Plug the piggyback switch into a dedicated grounded outlet and then plug the pump into the switch. Test the pump by filling the wetwell until the pump goes On. If the pumps run but fail to pump, they are probably air locked, drill the relief holes per the instructions in the Piping Section.

Check the operating range to insure a minimum one minute run time and that the pump goes Off in the correct position.

Control Panel Operation – Fill the wetwell with clear water.

Use the pump H-O-A (Hand-Off-Automatic) switches in Hand to test the pumps. If they operate well in Hand proceed to test Automatic operation. If the pumps run but fail to pump, they are probably air locked, drill the relief holes per the instructions in the Piping Section.

Place Control Panel switch(es) in Automatic position and thoroughly test the operation of the ON, OFF, and Alarm floats by filling the wetwell with clear water. **Important:** Failure to provide a Neutral from the power supply to a 10, 230 volt Control Panel will not allow the panel control circuit to operate. The Neutral is necessary to complete the 115 volt control circuit.

Check voltage and amperage and record the data on the front of this manual for future reference. Compare the amperage readings to the pump nameplate maximum amperage. If higher than nameplate amperage investigate cause. Operating the pump off the curve, i.e. with too little head or with high or low voltage will increase amperage. The motor will operate properly with voltage not more than 10% above or below pump nameplate ratings. Performance within this range will not necessarily be the same as the published performance at the exact rated nameplate frequency and voltage. Correct the problem before proceeding. Three phase unbalance is also a possible cause. *See Three Phase Power Unbalance and follow the instructions.*

Reset the Alarm circuit, place pump switch(es) in the Automatic position and Control Switch in ON position. The system is now ready for automatic operation.

Explain the operation of the pumps, controls and alarms to the end user. Leave the paperwork with the owner or at the control panel if in a dry, secure location.

## FLOAT SWITCH AND PANEL CHART

The purpose of this chart is to show the required switch quantities and the function of each switch in a typical wastewater system. The quantities required vary depending on the switch type, single-action or wide-angle. Switch quantities also vary by panel type: simplex with and without alarms, and duplex with alarms.

**Duplex Panels using single-action switches:**

Three Float Panel Wiring

| | | |
|---|---|---|
| SW1 | Bottom | Pumps Off |
| SW2 | Middle | 1st Pump On |
| SW3 | Top | 2nd Pump & Alarm On |

Four Float Panel Wiring ②

| | | |
|---|---|---|
| SW1 | Bottom | Pumps Off |
| SW2 | 2nd | 1st Pump On |
| SW3 | 3rd | 2nd Pump On |
| SW4 | Top | Alarm On |

**Duplex Panels using wide-angle switches:**

Three Float Panel Wiring

| | | |
|---|---|---|
| SW1 | Bottom | 1st Pump On/Both Off |
| SW2 | Top | 2nd Pump & Alarm On |

Four Float Panel Wiring

| | | |
|---|---|---|
| SW1 | Bottom | 1st Pump On/Both Off |
| SW2 | Middle | 2nd Pump On |
| SW3 | Top | Alarm On |

**Simplex Panel using single-action switches:**

Simplex Panel with Alarm ①

| | | |
|---|---|---|
| SW1 | Bottom | Pump Off |
| SW2 | Middle | Pump On |
| SW3 | Top | Alarm On/Off |

Simplex Panel with No Alarm

| | | |
|---|---|---|
| SW1 | Bottom | Pump Off |
| SW2 | Top | Pump On |

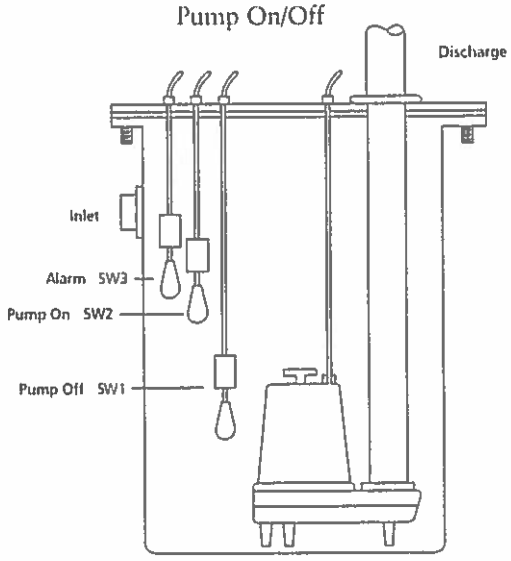
**Simplex Panel using wide-angle switches:**

Simplex Panel with Alarm

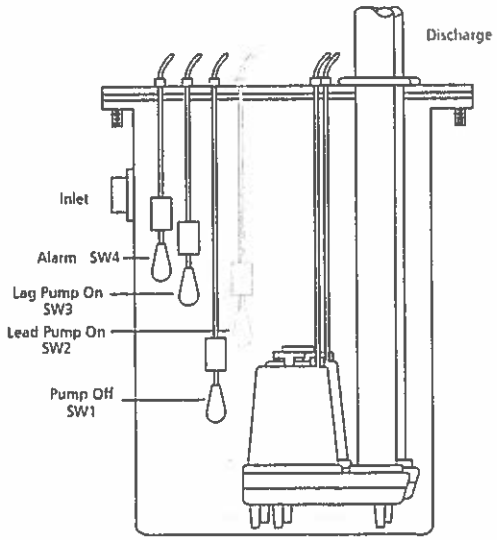
| | | |
|---|---|---|
| SW1 | Bottom | Pump On/Off |
| SW2 | Top | Alarm On/Off |

Simplex Panel with No Alarm

| | |
|---|---|
| SW1 | Pump On/Off |



Simplex ①



Duplex ②

## THREE PHASE POWER UNBALANCE

A full three phase supply consisting of three individual transformers or one three phase transformer is recommended. "Open" delta or wye connections using only two transformers can be used, but are more likely to cause poor performance, overload tripping or early motor failure due to current unbalance.

Check the current in each of the three motor leads and calculate the current unbalance as explained below.

If the current unbalance is 2% or less, leave the leads as connected.

If the current unbalance is more than 2%, current readings should be checked on each leg using each of the three possible hook-ups. Roll the motor leads across the starter in the same direction to prevent motor reversal.

To calculate percent of current unbalance:

A. Add the three line amp values together.

B. Divide the sum by three, yielding average current.

C. Pick the amp value which is furthest from the average current (either high or low).

D. Determine the difference between this amp value (furthest from average) and the average.

E. Divide the difference by the average. Multiply the result by 100 to determine percent of unbalance.

Current unbalance should not exceed 5% at service factor load or 10% at rated input load. If the unbalance cannot be corrected by rolling leads, the source of the unbalance must be located and corrected. If, on the three possible hookups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source.

Contact your local power company to resolve the imbalance.

| | Hookup 1 | | | Hookup 2 | | | Hookup 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Starter Terminals | L1 | L2 | L3 | L1 | L2 | L3 | L1 | L2 | L3 |
| | ⊥ T | ⊥ T | ⊥ T | ⊥ T | ⊥ T | ⊥ T | ⊥ T | ⊥ T | ⊥ T |
| Motor Leads | R | B | W | W | R | B | B | W | R |
| | T3 | T1 | T2 | T2 | T3 | T1 | T1 | T2 | T3 |

**Example:**

| | | |
|---|---|---|
| T3-R = 51 amps | T2-W = 50 amps | T1-B = 50 amps |
| T1-B = 46 amps | T3-R = 48 amps | T2-W = 49 amps |
| T2-W = 53 amps | T1-B = 52 amps | T3-R = 51 amps |
| Total = 150 amps | Total = 150 amps | Total = 150 amps |
| ÷ 3 = 50 amps | ÷ 3 = 50 amps | ÷ 3 = 50 amps |
| — 46 = 4 amps | — 48 = 2 amps | — 49 = 1 amps |
| 4 ÷ 50 = .08 or 8% | 2 ÷ 50 = .04 or 4% | 1 ÷ 50 = .02 or 2% |

## INSULATION RESISTANCE READINGS

**Normal Ohm and Megohm Values between all leads and ground**

| Condition of Motor and Leads | Ohm Value | Megohm Value |
|---|---|---|
| A new motor (without drop cable). | 20,000,000 (or more) | 20 (or more) |
| A used motor which can be reinstalled in well. | 10,000,000 (or more) | 10 (or more) |
| **Motor in well. Readings are for drop cable plus motor.** | | |
| New motor. | 2,000,000 (or more) | 2 (or more) |
| Motor in good condition. | 500,000 - 2,000,000 | .5 - 2 |
| Insulation damage, locate and repair. | Less than 500,000 | Less than .5 |

Insulation resistance varies very little with rating. Motors of all HP, voltage and phase ratings have similar values of insulation resistance.

Insulation resistance values above are based on readings taken with a megohmmeter with a 500V DC output. Readings may vary using a lower voltage ohmmeter, consult factory if readings are in question.

This table was reprinted through the courtesy of Franklin Electric.

Engineering data for specific models may be found in your catalog and on our website (address is on the cover).

Control panel wiring diagrams are shipped with the control panels. Please use the control panel drawings in conjunction with this instruction manual to complete the wiring.

| PUMP CONSTRUCTION | |
|---|---|
| **Minimum Submergence** | |
| Continuous Duty | Fully Submerged |
| Intermittent Duty | 6" Below Top of Motor |

| Maximum Fluid Temperature | |
|---|---|
| Continuous Operation | 104° F 40° C |
| Intermittent Operation | 140° F 60° C |

Pumpmaster and Pumpmaster Plus - Hard Wired

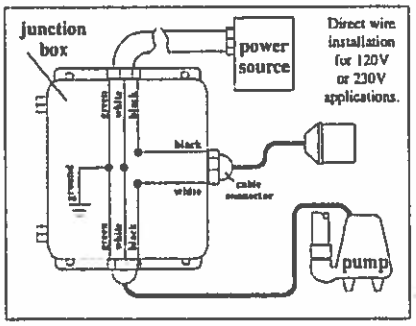



*Fig. 1*

Single-Action Float Switch "Typical" Installation

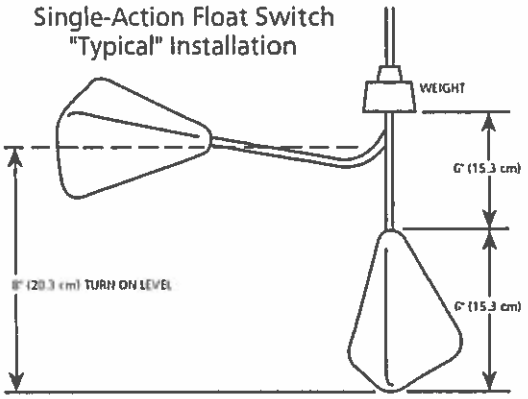



*Fig. 4*

Double Float - Hard Wired

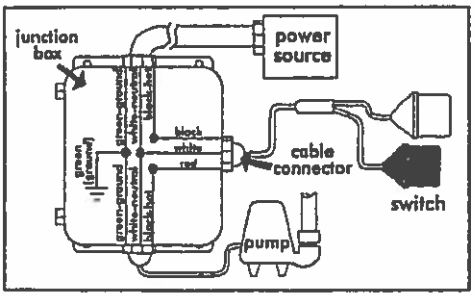



*Fig. 2*

Wide-Angle Float Switch

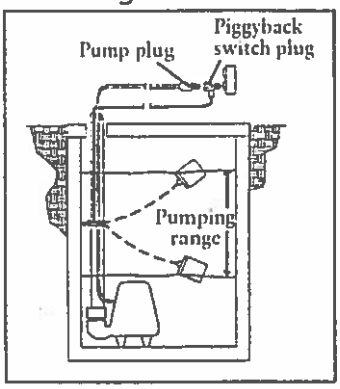



*Fig. 5*

Determining Pumping Range

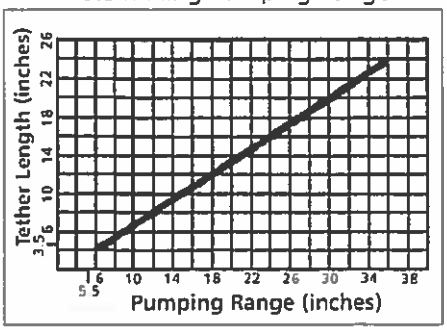



*Fig. 3*

Three Phase Connection Diagram

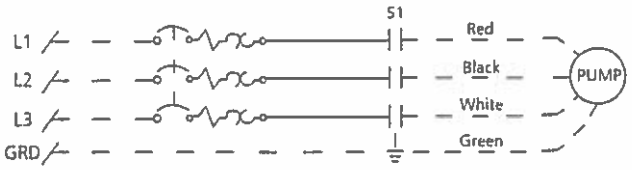
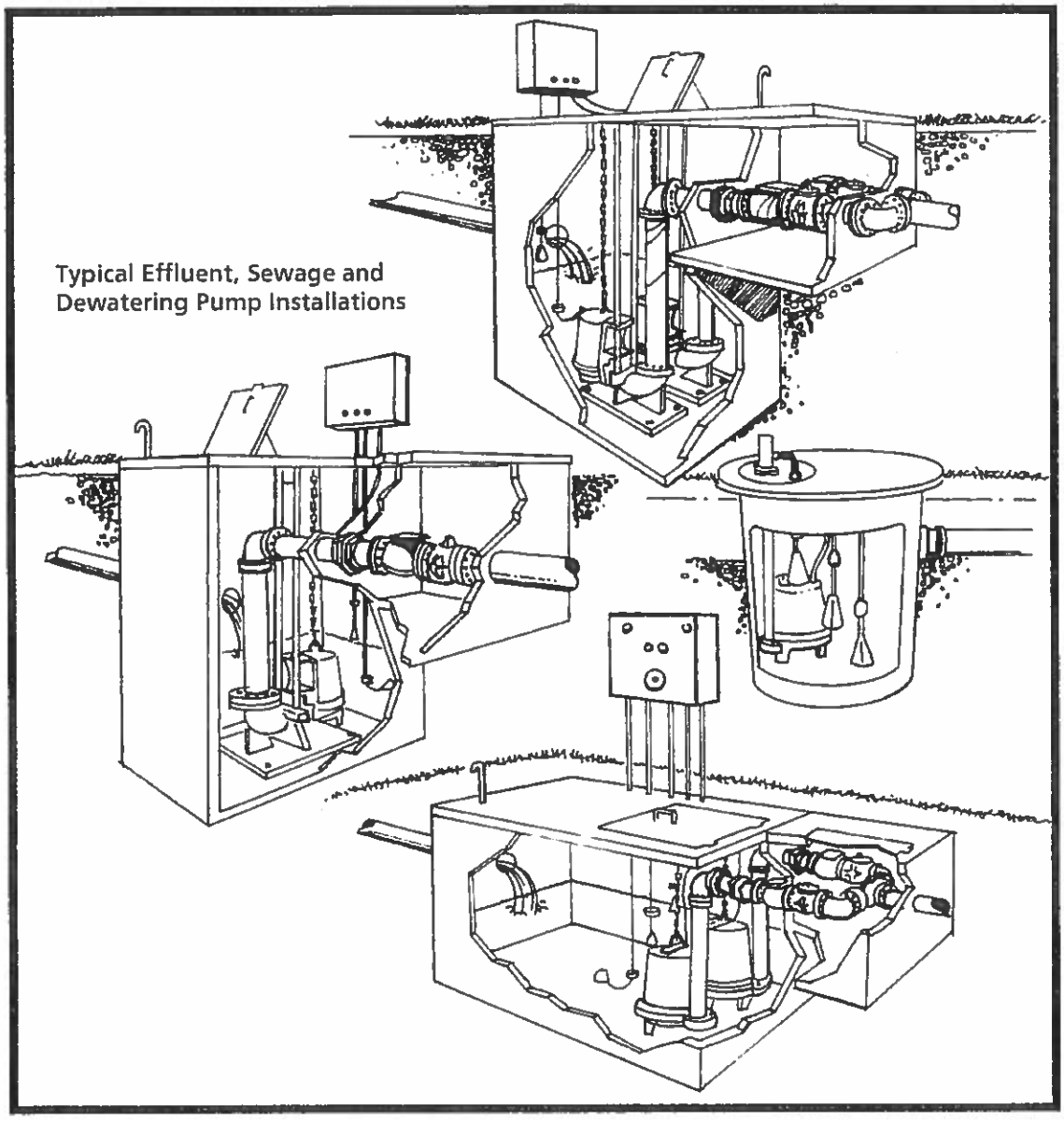



*Fig. 6*


Typical Effluent, Sewage and
Dewatering Pump Installations

**⚠WARNING** Hazardous voltage

FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY SERVICE CAN CAUSE SHOCK, BURNS OR DEATH.

| SYMPTOM | PROBABLE CAUSE | RECOMMENDED ACTION |
|---|---|---|
| MOTOR NOT RUNNING<br>NOTE: If circuit breaker "OPENS" repeatedly, DO NOT reset. Call qualified electrician. | Motor thermal protector tripped. | Allow motor to cool. Insure minimum pump submergence. Clear debris from casing and impeller. |
| | Open circuit breaker or blown fuse. | Determine cause, call a qualified electrician. |
| | Pump impeller binding or jammed. | Check motor amp draw. If two or more times higher than listed on pump nameplate, impeller is locked, motor bearings or shaft is damaged. Clear debris from casing and impeller, consult with dealer. |
| a) Manual operation | Power cable is damaged. | |
| | Inadequate electrical connection in control panel. | |
| b) Automatic operation | No neutral wire connected to control panel. | Resistance between power leads and ground should read infinity. If any reading is incorrect, call a qualified electrician. |
| | Inadequate electrical connection in control panel. | Inspect control panel wiring. Call a qualified electrician. |
| NOTE: Check the pump in manual mode first to confirm operation. If pump operates, the automatic control or wiring is at fault. If pump does not operate, see above. | Defective liquid level switch. | With switch disconnected, check continuity while activating liquid level switch. Replace switch, as required. |
| | Insufficient liquid level to activate controls. | Allow liquid level to rise 3" to 4" (76 mm - 101 mm) above turn-on level. |
| | Liquid level cords tangled. | Untangle cords and insure free operation. |
| PUMP WILL NOT TURN OFF | Liquid level cords tangled. | Untangle cords and insure free operation. |
| | Pump is air locked. | Shut off pump for approximately one minute, then restart. Repeat until air lock clears. If air locking persists in a system with a check valve, a 3/16" (4.8 mm) hole may be drilled in the discharge pipe approximately 2" (51 mm) above the discharge connection. |
| | Influent flow is matching pump's discharge capacity. | Larger pump may be required. |
| LITTLE OR NO LIQUID DELIVERED BY PUMP | Check valve installed backwards, plugged or stuck closed. | Check flow arrow on valve and check valve operation. |
| | Excessive system head. | Consult with dealer. |
| | Pump inlet plugged. | Inspect and clear as required. |
| | Improper voltage or wired incorrectly. | Check pump rotation, voltage and wiring. Consult with qualified electrician. |
| | Pump is air locked. | See recommended action, above. |
| | Impeller is worn or damaged. | Inspect impeller, replace as required. |
| | Liquid level controls defective or improperly positioned. | Inspect, readjust or replace as required. |
| PUMP CYCLES CONSTANTLY | Discharge check valve inoperative. | Inspect, repair or replace as required. |
| | Sewage containment area too small. | Consult with dealer. |
| | Liquid level controls defective or improperly positioned. | Inspect, readjust or replace as required. |
| | Influent excessive for this size pump. | Consult with dealer. |

## GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

**The warranty excludes:**

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

**For purposes of this warranty, the following terms have these definitions:**

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

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Goulds Pumps
ITT Industries

ITT

Wastewater

# Goulds Pumps

## WS_BHF Series Model 3887BHF

### Submersible Sewage Pump

Prosurance available for residential applications.




## FEATURES

- **Impeller:** Cast iron, enclosed, non-clog, dynamically balanced with pump out vanes for mechanical seal protection.
- **Casing:** Cast iron flanged volute type for maximum efficiency. Designed for easy installation on A10-20 slide rail or base elbow rail systems.
- **Mechanical Seal:** Silicon Carbide vs. Silicon Carbide sealing faces for superior abrasive resistance, stainless steel metal parts, BUNA-N elastomers.
- **Shaft:** Corrosion resistant, 300 series stainless steel. Threaded design. Locknut on all models to guard against component damage on accidental reverse rotation.
- **Fasteners:** 300 series stainless steel.
- Capable of running dry without damage to components.
- Designed for continuous operation, when fully submerged.

GOULDS PUMPS

## AGENCY LISTINGS

Tested to UL 778 and CSA 22.2 108 Standards
By Canadian Standards Association — File #LR38549

Goulds Pumps is ISO 9001 Registered.

Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

*Engineered for life*

## APPLICATIONS

Specifically designed for the following uses:

- Homes
- Water transfer
- Sewage systems
- Light industrial
- Dewatering/Effluent
- Commercial applications

Anywhere waste or drainage must be disposed of quickly, quietly and efficiently.

## SPECIFICATIONS

### Pump

- Solids handling capabilities: 2" maximum.
- Capacities: up to 220 GPM.
- Total heads: up to 81 feet TDH.
- Discharge size: 2" NPT threaded companion flange as standard. 3" option available but must be ordered separately. (Order no. A1-3)
- Temperature: 104°F (40°C) continuous
  140°F (60°C) intermittent.

## MOTORS

- Fully submerged in high grade turbine oil for lubrication and efficient heat transfer. All ratings are within the working limits of the motor.
- Class B insulation on ⅓-1½ HP models.
- Class F insulation on 2 HP models.

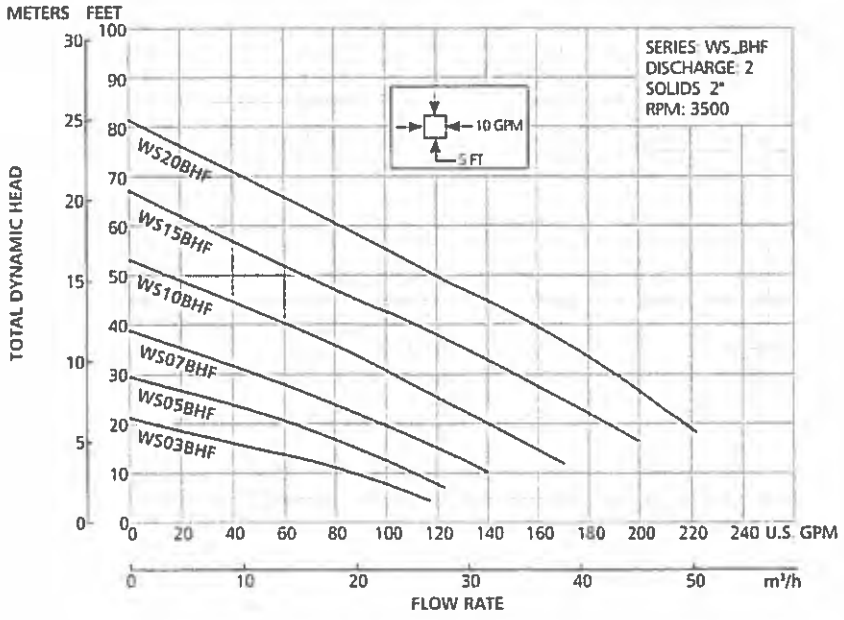
Single phase (60 Hz):

- Capacitor start motors for maximum starting torque.
- Built-in overload with automatic reset.
- SJTOW or STOW severe duty oil and water resistant power cords.
- ⅓ – 1 HP models have NEMA three prong grounding plugs.
- 1½ HP and larger units have bare lead cord ends.

Three phase (60 Hz):

- Class 10 overload protection must be provided in separately ordered starter unit.
- STOW power cords all have bare lead cord ends.

- **Designed for Continous Operation:** Pump ratings are within the motor manufacturer's recommended working limits, can be operated continuously without damage when fully submerged.
- **Bearings:** Upper and lower heavy duty ball bearing construction.
- **Power Cable:** Severe duty rated, oil and water resistant. Epoxy seal on motor end provides secondary moisture barrier in case of outer jacket damage and to prevent oil wicking. Standard cord is 20'. Optional lengths are available.
- **Motor Cover O-ring:** Assures positive sealing against contaminant and oil leakage.

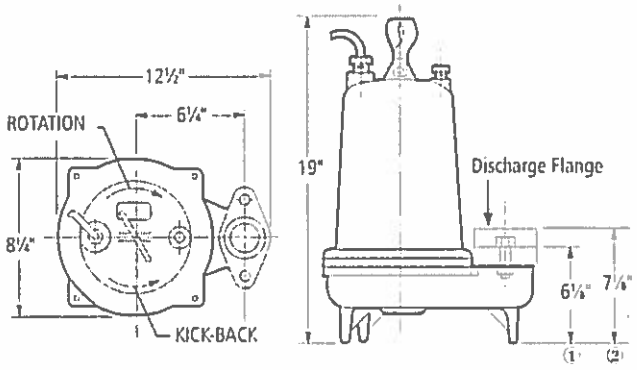


## MOTOR AND MODEL INFORMATION

| ORDER NUMBER | HP | PHASE | VOLTS | RPM | IMPELLER DIA. (IN.) | MAX. AMPS | LOCKED ROTOR AMPS | KVA CODE | FULL LOAD MOTOR EFF. % | RESISTANCE | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | START | LINE-LINE |
| WS0311BHF | 0.33 | 1 | 115 | 3500 | 2.94 | 12.4 | 46.0 | M | 54 | 7.5 | 1.0 |
| WS0318BHF | 0.33 | 1 | 208 | | | 6.8 | 31.0 | K | 68 | 9.7 | 2.4 |
| WS0312BHF | 0.33 | 1 | 230 | | | 6.2 | 34.5 | M | 53 | 9.6 | 4.0 |
| WS0511BHF | 0.5 | 1 | 115 | | 3.19 | 14.5 | 46.0 | M | 54 | 7.5 | 1.0 |
| WS0518BHF | 0.5 | 1 | 208 | | | 8.4 | 31.0 | K | 68 | 9.7 | 2.4 |
| WS0512BHF | 0.5 | 1 | 230 | | | 7.6 | 34.5 | M | 53 | 9.6 | 4.0 |
| WS0538BHF | 0.5 | 3 | 200 | | | 4.9 | 22.6 | R | 68 | – | 3.8 |
| WS0532BHF | 0.5 | 3 | 230 | | | 3.6 | 18.8 | R | 70 | – | 5.8 |
| WS0534BHF | 0.5 | 3 | 460 | | | 1.8 | 9.4 | R | 70 | – | 23.2 |
| WS0537BHF | 0.5 | 3 | 575 | | | 1.5 | 7.5 | R | 62 | – | 35.3 |
| WS0718BHF | 0.75 | 1 | 208 | | 3.44 | 11.0 | 31.0 | K | 68 | 9.7 | 2.4 |
| WS0712BHF | 0.75 | 1 | 230 | | | 10.0 | 27.5 | J | 65 | 12.2 | 2.7 |
| WS0738BHF | 0.75 | 3 | 200 | | | 6.2 | 20.6 | L | 64 | – | 5.7 |
| WS0732BHF | 0.75 | 3 | 230 | | | 5.4 | 15.7 | K | 68 | – | 8.6 |
| WS0734BHF | 0.75 | 3 | 460 | | | 2.7 | 7.9 | K | 68 | – | 34.2 |
| WS0737BHF | 0.75 | 3 | 575 | | | 2.2 | 9.9 | L | 78 | – | 26.5 |
| WS1018BHF | 1 | 1 | 208 | | 3.75 | 14.5 | 59.0 | K | 68 | 9.3 | 1.1 |
| WS1012BHF | 1 | 1 | 230 | | | 13.0 | 36.2 | J | 69 | 10.3 | 2.1 |
| WS1038BHF | 1 | 3 | 200 | | | 8.6 | 27.6 | M | 77 | – | 2.7 |
| WS1032BHF | 1 | 3 | 230 | | | 7.5 | 24.1 | L | 79 | – | 4.1 |
| WS1034BHF | 1 | 3 | 460 | | | 3.8 | 12.1 | L | 79 | – | 16.2 |
| WS1037BHF | 1 | 3 | 575 | | | 3.1 | 9.9 | L | 78 | – | 26.5 |
| WS1512BHF | 1.5 | 1 | 230 | | 4.00 | 18.0 | 52.0 | J | 67 | 2.76 | 0.53 |
| WS1538BHF | 1.5 | 3 | 200 | | | 10.0 | 42.4 | K | 78 | – | 1.7 |
| WS1532BHF | 1.5 | 3 | 230 | | | 9.6 | 42.4 | K | 78 | – | 1.7 |
| WS1534BHF | 1.5 | 3 | 460 | | | 4.8 | 21.2 | K | 78 | – | 6.6 |
| WS1537BHF | 1.5 | 3 | 575 | | | 3.9 | 16.3 | L | 78 | – | 10.5 |
| WS2012BHF | 2 | 1 | 230 | | 4.44 | 18.0 | 49.6 | F | 78 | 3.2 | 1.1 |
| WS2038BHF | 2 | 3 | 200 | | | 12.0 | 42.4 | K | 78 | – | 1.7 |
| WS2032BHF | 2 | 3 | 230 | | | 11.6 | 42.4 | K | 78 | – | 1.7 |
| WS2034BHF | 2 | 3 | 460 | | | 5.8 | 21.2 | K | 78 | – | 6.6 |
| .WS2037BHF | 2 | 3 | 575 | | | 4.7 | 16.3 | L | 78 | – | 10.5 |

## DIMENSIONS

(All dimensions are in inches. Do not use for construction purposes.)




Discharge Flange:

① 2" NPT standard

② 3" NPT optional (order an A1-3)

ITT

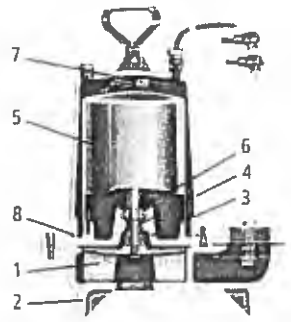
Wastewater

## PERFORMANCE RATINGS (gallons per minute)

| Order No. | | WS03BHF | WS05BHF | WS07BHF | WS10BHF | WS15BHF | WS20BHF |
|---|---|---|---|---|---|---|---|
| HP ▶ | | ⅓ | ½ | ¾ | 1 | 1½ | 2 |
| RPM ▶ | | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| Total Head Feet of Water | 10 ▶ | 86 | 110 | 140 | – | – | – |
| | 15 | 48 | 88 | 120 | 158 | – | – |
| | 20 | – | 62 | 98 | 139 | 186 | 217 |
| | 25 | – | 32 | 74 | 120 | 170 | 204 |
| | 30 | – | – | 49 | 101 | 150 | 190 |
| | 35 | – | – | 21 | 82 | 130 | 175 |
| | 40 | – | – | – | 60 | 110 | 159 |
| | 45 | – | – | – | 38 | 88 | 140 |
| | 50 | – | – | – | – | 67 | 120 |
| | 55 | – | – | – | – | 47 | 100 |
| | 60 | – | – | – | – | 29 | 80 |
| | 65 | – | – | – | – | – | 62 |
| | 70 | – | – | – | – | – | 43 |
| | 75 | – | – | – | – | – | 23 |

## COMPONENTS *(for reference only)*

| Item No. | Description |
|---|---|
| 1 | Impeller |
| 2 | Casing |
| 3 | Mechanical Seal |
| 4 | Motor Shaft |
| 5 | Motor |
| 6 | Ball Bearings |
| 7 | Power Cable |
| 8 | Casing O-Ring |




** For repair parts, reference repair parts book*

GOULDS PUMPS

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SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

**B3887BHF April, 2007**

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*Engineered for life*

MotorSaver®
THREE-PHASE ELECTRIC MOTOR PROTECTOR

# INSTALLATION INSTRUCTIONS FOR SYMCOM'S MOTORSAVER®
# MODEL 460

**DANGER!**

**HAZARDOUS VOLTAGES MAY BE PRESENT DURING INSTALLATION.**
**Electrical shock can cause death or serious injury.**
**Installation should be done by qualified personnel following all national, state and local electrical codes.**

**BE SURE POWER IS DISCONNECTED PRIOR TO INSALLATION!**
**FOLLOW NATIONAL, STATE, AND LOCAL CODES!**
**READ THESE INSTRUCTIONS ENTIRELY BEFORE INSTALLATION!**

**! WARNING !**

**UNEXPECTED OUTPUT ACTUATION CAN OCCUR.**
**Use hard-wired safety interlocks where personnel and/or equipment hazards exist.**
**Failure to follow this instruction can result in death, injury or equipment damage.**

The Model 460 MotorSaver® is an auto ranging voltage monitor designed to protect three-phase motors regardless of size. The MotorSaver® is used on 190-480 VAC, 50 to 60 Hz motors to protect from damage caused by single phasing, low voltage, high voltage, phase reversal, and voltage unbalance.

## CONNECTIONS

1. Mount the MotorSaver® in a convenient location in or near the motor control panel. If the location is wet or dusty, the MotorSaver® should be mounted in a NEMA 4 or 12 enclosure. The MotorSaver® can be mounted to a back panel using two #6 or #8 x 5/8 screws or can be snapped onto a DIN rail.
2. Connect L1, L2 and L3 on the MotorSaver's terminal strip to the LINE SIDE of the motor starter. (See Figure No. 1).
3. Connect the output relay to the circuitry to be controlled. For motor control, connect the normally open contact in series with the magnetic coil of the motor starter as shown in Figure No. 1. For alarm operation, connect the normally closed contact in series with the control circuit as shown in Figure No. 2.

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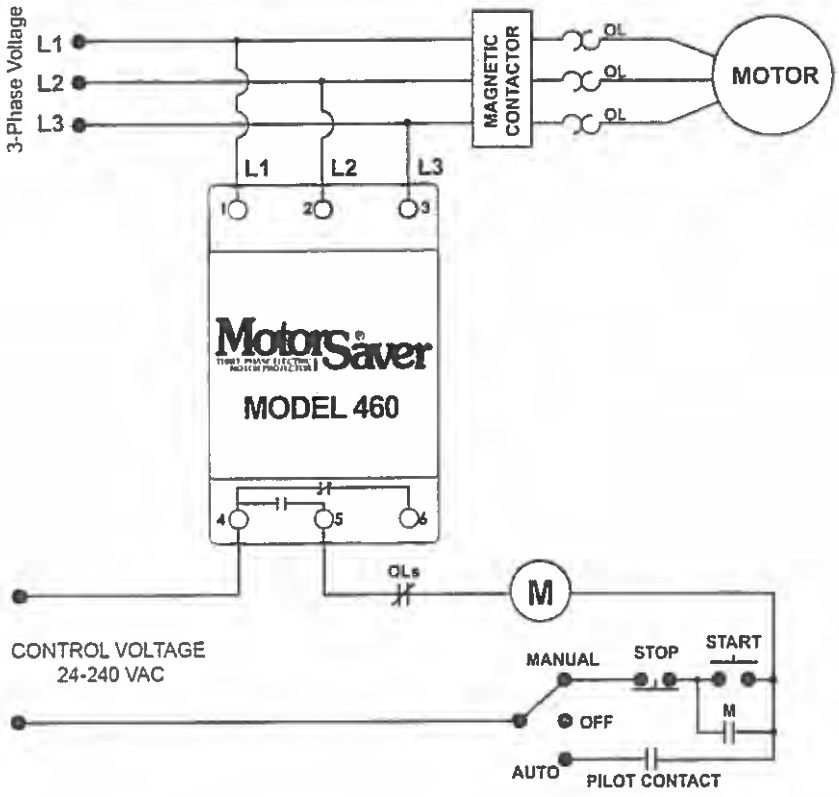



FIGURE NO. 1: CONTROL WIRING DIAGRAM

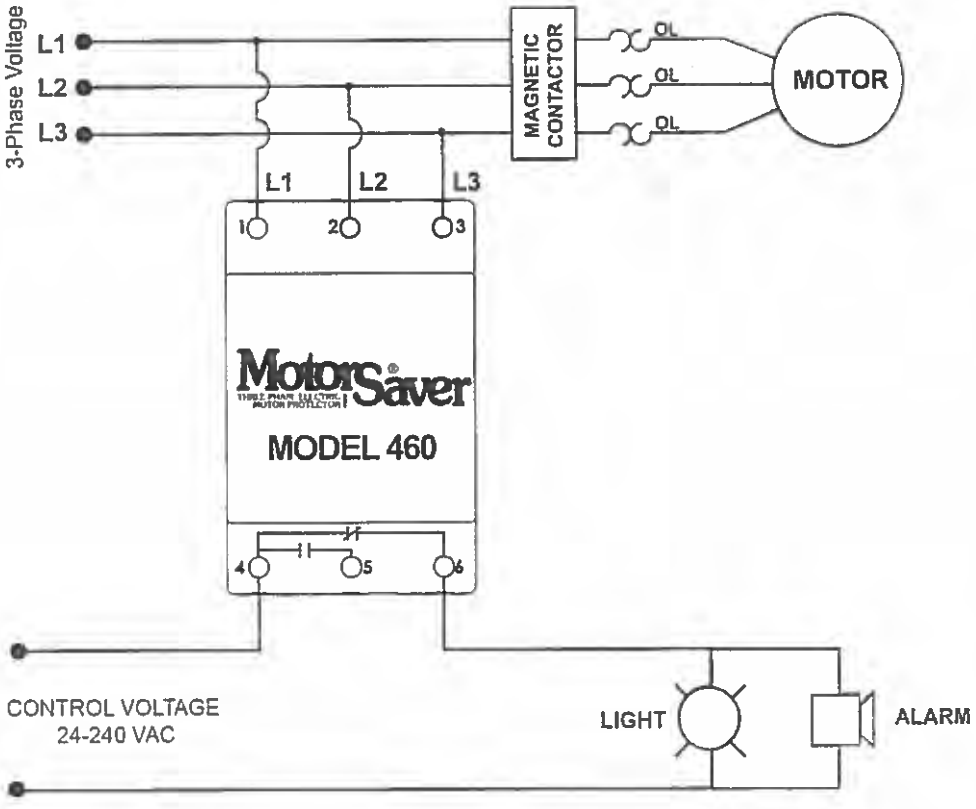
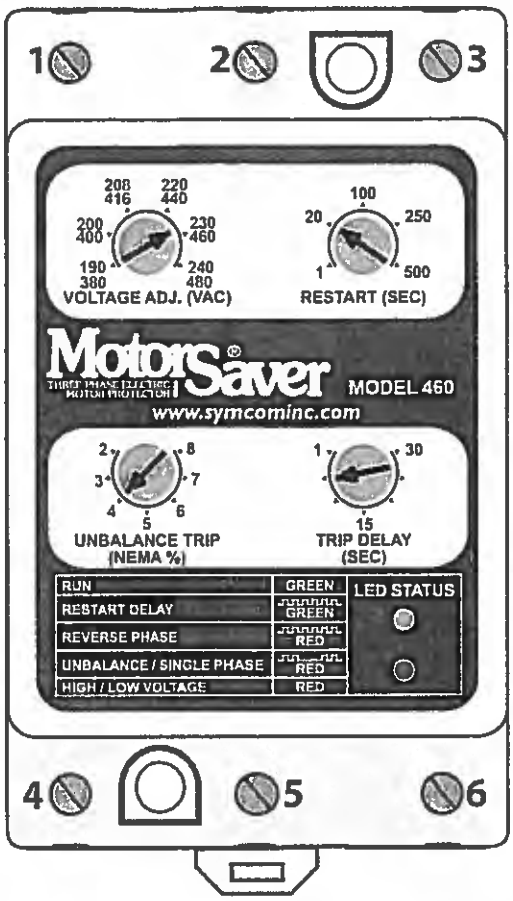



FIGURE NO. 2: ALARM WIRING DIAGRAM

## SETTINGS




1. Line voltage adjustment: Rotate the **"VOLTAGE ADJ. (VAC)"** to the nominal three-phase line voltage feeding the motor to be protected.
2. Restart delay adjustment: Rotate the **"RESTART (SEC)"** adjustment to the desired position. The restart delay is the time between MotorSaver® seeing acceptable voltage and the MotorSaver® closing its output contacts. For compressor applications, the restart delay should be set for the approximate time it takes for the head pressure to bleed off of the compressor. For other applications, the restart delay is typically set between 2 and 10 seconds.
3. Trip delay adjustment: Rotate the **"TRIP DELAY (SEC)"** adjustment to the desired setting. This adjustment does not affect the trip delay on phasing faults. Typically, the trip delay adjustment is set between 1 and 5 seconds. In areas where voltage fluctuations are frequent, the trip delay adjustment may be set greater than 10 seconds.
4. Voltage unbalance adjustment: Rotate the **"UNBALANCE TRIP (NEMA%)"** adjustment to the desired unbalance trip level. The NEMA MG1 standard does not recommend operating a motor above 1% voltage unbalance without derating the motor. The NEMA MG1 standard also recommends against operating a motor above a 5% voltage unbalance under any circumstances. SymCom recommends consulting the motor manufacturer for specific tolerances.

$$\text{Percent Unbalance} = \frac{\text{Maximum Deviation from the Average}}{\text{Average}} \times 100$$

Example: The measured line-to-line voltages are 203, 210, and 212.

$$\text{Average} = \frac{203 + 210 + 212}{3} = 208.3$$

The maximum deviation from the average is the largest difference between the average voltage (208.3) and any one voltage reading.

208.3 - 203 = 5.3  210 - 208.3 = 1.7  212 - 208.3 = 3.7

The maximum deviation from the average is 5.3.

$$\frac{5.3}{208.3} \times 100 = 2.5\% \text{ Unbalance}$$

## POWER-UP

Turn on the 3∅ power to the motor. The MotorSaver's green RUN light will blink during the RESTART delay. After the RESTART delay, the MotorSaver® will energize its output contacts and the green RUN light will illuminate. If the contacts do not energize and the RUN light does not illuminate, see the TROUBLESHOOTING section.

| DIAGNOSTIC INDICATOR LIGHTS | |
|---|---|
| RUN | GREEN |
| RESTART DELAY |  GREEN |
| REVERSE PHASE |  RED |
| UNBALANCE / SINGLE PHASE |  RED |
| HIGH / LOW VOLTAGE | RED |

## CONGRATULATIONS!!
## YOU HAVE JUST INSTALLED THE FINEST MOTOR PROTECTION AVAILABLE!!

## TROUBLESHOOTING

| SYMPTOM | LIGHT PATTERN | SOLUTION |
|---|---|---|
| No lights are on. The unit seems completely dead. | N / A | Measure the three line-to-line voltages. If any of the voltages are below 150 VAC, the MotorSaver® does not have enough power to operate its internal electronics. This may occur on a single-phased system. If the voltages are correct, call SymCom at 1-800-843-8848 or 1-605-348-5580. |
| Red light is blinking (on initial power up). |  RED | Turn off the three-phase power. Swap any two leads powering the MotorSaver® (L1, L2, or L3). There is a 50-50 chance of connecting L1, L2, and L3 correctly the first time. Re-apply the three-phase power. |
| Red light is blinking (after the motor has been previously running). |  RED | The incoming lines have been reverse phased. The MotorSaver® is preventing the motor from running backwards. Correct the phase sequence. |
| Red light is blinking in this pattern. |  RED | The voltage is unbalanced or single-phased. Measure the incoming line voltages and calculate the % unbalance. If the voltage unbalance does not exceed the % unbalance reset value, call SymCom at 1-800-843-8848 or 1-605-348-5580. |
| Red light is on steady. | RED | The voltage is out of tolerance. Measure the three line-to-line voltages. Calculate the average of the three voltages. If the average is 7% above or below the nominal voltage as selected by the LINE VOLTAGE ADJUST, the MotorSaver® is functioning properly. If the voltage is within ±7% of the selected line voltage, call SymCom at 1-800-843-8848 or 1-605-348-5580. |
| Green light blinks and motor is not running. |  GREEN | The MotorSaver® is in restart delay. |
| Green light is on steady, but motor does not start. | GREEN | The MotorSaver® is in run mode. Ensure other control devices are allowing the motor to start. Check control circuit for loose wires or malfunctioning switches. |

**Any questions or comments call SymCom at 1-800-843-8848 or 1-605-348-5580**

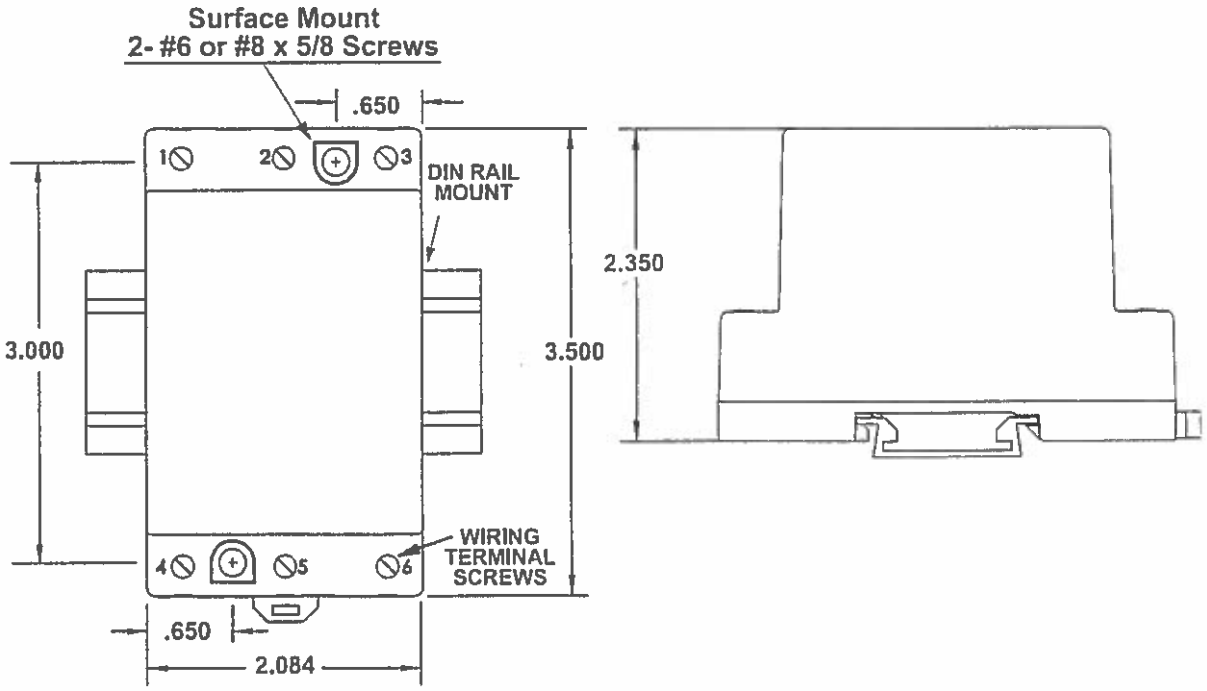
## SPECIFICATIONS

| | |
|---|---|
| **3 - Phase Line Voltage** | 190 - 480 VAC |
| **Frequency** | 50* - 60 Hz |
| **Low Voltage (% of setpoint)** | |
| Trip | 90% ± 1% |
| Reset | 93% ± 1% |
| **High Voltage (% of setpoint)** | |
| Trip | 110% ±1% |
| Reset | 107% ±1% |
| **Voltage Unbalance (NEMA)** | |
| Trip | 2 - 8% Adjustable |
| Reset | Trip Setting minus 1% (5 - 8%) |
| | Trip Setting minus 0.5% (2 - 4%) |
| **Trip Delay Time** | |
| Low, High, and Unbalanced Voltage | 1 - 30 Seconds Adjustable |
| Single-phasing faults (>25% UB) | 1 Second Fixed |
| **Restart Delay Time** | |
| After a fault or complete power loss | 1 - 500 Seconds Adjustable |
| **Output Contact Rating - SPDT** | |
| Pilot Duty | 480 VA @ 240 VAC |
| General Purpose | 10 A @ 240 VAC |
| **Power Consumption** | 6 Watts (maximum) |
| **Weight** | 14 oz |
| **Enclosure** | Polycarbonate |
| **Terminal** | |
| Torque | 6 Inch-Pounds Max. |
| Wire AWG | 12 - 20 AWG |
| **Safety Marks** | |
| UL | UL508 (File # E68520) |
| CE | IEC 60947-6-2 |
| **Standards Passed** | |
| Electrostatic Discharge (ESD) | IEC 1000-4-2, Level 3, 6 kv contact, 8 kv air |
| Radio Frequency Immunity, Radiated | 159 MHz, 10 V/m |
| Fast Transient Burst | IEC 1000-4-4, Level 3, 3.5 kv input power and controls |

*NOTE: 50 Hz will increase all delay timers by 20%

| Surge | |
|---|---|
| IEC | IEC 1000-4-5, Level 3, 4kv line-to-line; Level 4, 4kv line-to-ground |
| ANSI / IEEE | C62.41 Surge and Ring Wave Compliance to a level of 6kv line-to-line |
| Hi-potential Test | Meets UL508 (2 x rated V +1000V for 1 minute) |
| **Environmental** | |
| Temperature Range | Ambient Operating: -20° - 70° C (-4° - 158°F) Ambient Storage: -40° - 80° C (-40° - 176°F) |
| Class of Protection | IP20, NEMA 1 (Finger Safe) |
| Relative Humidity | 10-95%, non-condensing per IEC 68-2-3 |

## DIMENSIONS




SymCom warrants its microcontroller based products against defects in material or workmanship for a period of five (5) years* from the date of manufacture. All other products manufactured by SymCom shall be warranted against defects in material and workmanship for a period of two (2) years from the date of manufacture. For complete information on warranty, liability, terms, and conditions, please refer to the SymCom Terms and Conditions of Sale document.

**Visit our website at www.symcominc.com for our complete catalog and new product listings!**

SymCom Inc
Motor Protection & Controls Since 1974

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Phone: (800) 843-8848 or (605) 348-5580
FAX: (605) 348-5685

***Warning: This document does not replace the manufacturer's recommended maintenance schedules as referenced in the OM manual provided by the equipment manufacturer. It is provided as a quick guide to required OM activities for this project.***

**Section1: General Maintenance Activities**
**Section2: Cross Reference Maintenance Code to Parts**
**Section3: Maintenance Schedule by Hours**

# *General Maintenance Activities*

## Daily

- Check the control panel for running status.
- Contact the system remotely to check system operation for:
  - Alarms
  - Operating Conditions

## Weekly

- Check for Leaks.
- Check the volume of consumables. i.e. Chemicals, oil etc
- Check for excessive noise of various components.
- Check for Alarms.
- Check and record Flow Rates, Vacuums, Pressures, Temperatures, pH.
- Check for excessive moisture inside the control panels and transducer wiring boxes.
- Check for corrosion and grease the moving parts if required to reduce corrosion.

## Monthly

- Test critical inputs for proper shutdown capacity.
- Test the operation of the overloads.
- Test building sump switch if it is present.

## Yearly

- Test each input.
- Test alarm conditions.
- Test the operation of each output device.

## Parts Listing per Maintenance Code

### Fan

| | Part | | Qty | Module |
|---|---|---|---|---|
| *F-7901* | 10329 | Fan, Building, 24", 1/3hp, 1625rpm, 120/230V, 1ph, XPF | 1 | Building, Trailer or Skid |
| *F-7903* | M1072 | Fan, Building, 12", 1/4hp, 1750rpm, 120V, 1ph, TEFC | 1 | Building, Trailer or Skid |

### Flow Meter (Liquid)

| | Part | | Qty | Module |
|---|---|---|---|---|
| *FQI,FT-7001* | 15499 | Meter, Water, 2", US Gal, w/ pulse, Turbine, DLJ | 1 | Liquid Phase Carbon |

### Gauge, Pressure

| | Part | | Qty | Module |
|---|---|---|---|---|
| *PI-7001* | 16203 | Gauge, Pressure, 0-60psi, Indumart, P16T2-FG-60 | 2 | Liquid Phase Carbon |
| *P-4901* | 16203 | Gauge, Pressure, 0-60psi, Indumart, P16T2-FG-60 | 1 | Oil/Water Separator |

### Oil Water Separator

| | Part | | Qty | Module |
|---|---|---|---|---|
| *OWS-4901* | 16263 | Oil Water Separator, OWS-24, Stainless | 1 | Oil/Water Separator |

### Pump, Discharge

| | Part | | Qty | Module |
|---|---|---|---|---|
| *P-4901* | 21028 | Pump, Suction, Goulds, SSH Series, 4SH2K52C0 | 1 | Oil/Water Separator |

### Strainer

| | Part | | Qty | Module |
|---|---|---|---|---|
| *P-4901* | M1523 | Strainer, Wye, Brass, 3" | 1 | Oil/Water Separator |

### Vertical Level Switch (Almeg)

| | Part | | Qty | Module |
|---|---|---|---|---|
| *LSHH-5201* | 12351 | Switch, Level, Almeg, Vertical, ATB3-48B | 1 | Product Storage Tank |

EVERY 200 OPERATING HOURS

## Strainer

Remove strainer basket. Inspect strainer and empty if necessary.

EVERY 800 OPERATING HOURS

## Pump, Discharge

Close-Coupled Unit
Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

Frame-Mounted Units
Regrease frame with a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seal. Then wipe off excess. Follow motor and coupling manufacturers' lubrication instructions.

Note: Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

## Fan

1) Check the fan outlet pressure.
2) Check to ensure nothing is obstructing the air intake.
3) Check the fan wheel for corrosion.
4) Check the fan wheel alignment and positioning.

## Flow Meter (Liquid)

Test the operation of the flow meter. Disassemble and clean the internal components if dirt or particles are preventing the meter from working properly.

## Vertical Level Switch (Almeg)

1) Test the operation of the switch.
2) Remove the switch and check for debris buildup that can potentially cause a failure of normal operation.

EVERY **4000** OPERATING HOURS

## Gauge, Pressure

1) Check accuracy of gauges.
2) Zero gauge if required.

## Oil Water Separator

After the first 6 months of operation, the inlet should be inspected and cleaned as follows:
1) Stop the flow of influent to the separator.
2) Remove separator cover.
3) Dispose of separated oil per regular procedures.
4) Remove water from separator through drain or hose. Measure and record the depth of the solids. Use this measurement as the timing basis for the next solids inspection and clean out. Consult OWS drawing for depth of sludge baffle. Solids should not exceed this depth.
5) The HD Q-PAC plates can be either cleaned in place or removed and cleaned.
6) Examine the tank interior for damage and repair any damage to internal coating.
7) To restart separator, install HD Q-PAC plate packs and polishing pack in original position. Make sure that both are securely in place so that they do not float when unit is operational.

# WINTER OPERATION AND STORAGE IN COLD CLIMATES

## GENERAL

Systems operating in climates where seasonal temperatures regularly fall below freezing may need to be winterized. Depending on the equipment in the system, different steps must be taken to prepare for winter operation.

If the system is going to be shut down and stored for the winter, additional measures should be taken above and beyond normal maintenance practices for an extended shut down.

## SYSTEMS OPERATING THOUGH THE WINTER

- Confirm that the enclosure heater is working. This can be done by adjusting the set point on the low temperature switch (TSL) to a setting above the ambient temperature inside the enclosure. Verify that the heater has turned on before adjusting the setting on the low temperature switch to a point above 32℉. If the heater is controlled by a temperature transmitter (TT), the set point can be adjusted through the HMI.
- Confirm that the control panel heater is working by adjusting the thermostat inside the panel – follow the procedure above.
- If the enclosure has a sump with a high level switch, ensure the sump is free of water to prevent ice from forming and potentially disabling the switch.
- If the system has a heat exchanger or rotary screw compressor, provisions may be included to prevent cycling cold air through the system. Depending on the design of the system, the following options may be available for winter operation:
    - Systems where the heat exchanger/compressor is recessed from the wall or ceiling, by removing the hood and withdrawing the insert, the discharge port can be fully or partially boarded up to allow warm air to be re-circulated back into the enclosure. See Figure 1.
    - The hood provided on the exterior of the enclosure may have been designed to allow air to be re-circulated back into the container through a duct on the wall above the heat exchanger/compressor or through the roof. See Figure 2.

*Note: Depending on the parameters of the system, the above mentioned options may need to be fine-tuned onsite to optimize performance of the system. While these methods are good for maintaining the temperature inside the enclosure above freezing, there are some situations where too much air is being re-circulated and the heat exchanger is not able to cool the process air sufficiently. This will cause the high temperature switch on the discharge of the heat exchanger to trip and send the system into alarm.*

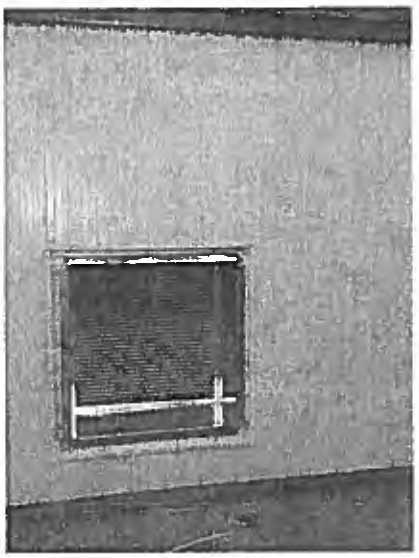


*Figure 1: Recessed Heat Exchanger*



*Figure 2: Re-circulating Hood*

## SYSTEMS BEING STORED THROUGH THE WINTER

- All water must be drained from the system where possible.
- Valves should be left open to allow ice to expand in the event residual water was left in the system without damaging piping or equipment.
- Additional O&M as required for long-term system shutdowns.

## WINTERIZING PROCEDURE

Progressive Cavity Pumps (Moyno)

- Remove bolts from pump end and ensure all water is removed.

Centrifugal Pumps (Goulds)

- Remove drain plug on the bottom of the outer steel body. Keep in mind water inside lines will also drain through these plugs depending on elevations.

Inlet Manifolds

- Drain all water from SVE and ground water extraction manifolds.

Vapor/Liquid Separators

- Drain all water from VLS.

Bag Filter Housings

- Drain all water and remove bag filter from housing.
- Pour antifreeze into bottom of housing ensuing drain valve is closed.

Oil/Water Separators

- Pour antifreeze in bottom of OWS, filling 1 to 2" from the bottom, ensuring drain lines are filled with antifreeze.

Air Strippers

- Sump should be drained and trays disassembled.
- Pour antifreeze in bottom of stripper and ensure drain lines are filled with antifreeze.

Air Compressors

- Drain receiver tank of any condensate.

Water Flow Meters (Paddlewheels and Rotameters)

- Remove via unions and drain. Store for the winter.



**CAUTION**

Freezing water poses a serious threat to the equipment in a system. Pipes, vessels and pumps can be severely damaged by freezing water.

# Troubleshooting Chart

| Symptom | Potential Cause | Possible Solution |
|---|---|---|
| **Electrical Motor** | | |
| Motor will not start and there is no noise | Motor may not be receiving the proper power. | Check fuses and power distribution between power lines to motor. |
| | Overload is tripped. | Reset overload. |
| | Main power may be off. | Check main power. |
| | Contactor may not be closing because motor is in manual position. | Switch motor to Auto position. |
| | Contactor may not be closing because PLC is not telling output to be on. | Check PLC operating sequence to determine if a start requirement is not met. |
| Motor will not start but makes a humming noise. | One of the phases of power is not getting to the Motor as a result of a blown fuse. | Change fuse. |
| | One of the phases of power is not getting to the Motor as a result of a poor wire connection. | Check wiring for a loose wire or a poor connection. |
| | The driven component (i.e. pump) will not spin and could be seized up. | Disassemble driven component, check clearances and clean internal components and replace any damaged components. |
| | Bearing on drive shaft of motor or driven component may be seized up. | Replace bearings. |
| Overloads trip immediately after startup. | Check for short circuit in motor windings. | Re-wind motor. |
| | One of the phases of power is not getting to the motor as a result of a blown fuse. | Change fuse. |
| | Motor power wires may be shorting out to ground. | Search for wiring short and replace wiring if required. |
| | Motor may have too much load or backpressure as a result of operating the driven component outside of its operating capabilities. | Check operating capabilities of driven component. I.e. Ensure positive displacement pump is not over pressured or that centrifugal pump is not operating at too high a flow rate. |
| Motors amps are above the allowable value on the nameplate. | Motor may be designed to operate on the upper limit. | Calculate maximum allowable amps. Name plate amps x safety factor. |
| | Driven component may have scale build up inside. | Clean internal components of driven component. |

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| | Driven component may be rotating in the wrong direction. | Check direction of rotation and switch rotation of motor if it is incorrect. |
| | Check voltage of power. Low voltage results in high amps. | Adjust overloads for higher amps if the difference is only slight, otherwise change power or motor. |
| **Centrifugal Pumps** | | |
| Pump does not produce sufficient pressure/vacuum. | Pump is not primed. | Prime pump. |
| | Pump is rotating in wrong direction. | Check and change rotation if required. |
| | Vacuum or pressure gauge is faulty. | Replace gauge. |
| | Pump is not operating at required RPM. | Check and replace motor if required. |
| | Pump has wrong sized impeller. | Check impeller and replace if required. |
| | Pump pressure or vacuum is lost due to an obstruction located between the pump and gauge. | Check for flow restrictions and clean strainers or piping if required. |
| | Pump is not turned on. | Turn pump on. |
| | Coupling between pump and motor is no longer connected preventing the pump from rotating with the motor. | Reconnect and realign motor and pump. |
| Pump is leaking. | Gaskets are worn or faulty. | Replace gaskets. |
| | Mechanical seal has been overheated. This is often a result of operating the pump without any water. | Replace mechanical seal. |
| | Fittings are leaking on or around pump. | Tighten fittings. |
| | Water may be coming from another location. | Check for leaks around pump. |
| Pump flow rate is too low. | Backpressure is too high for pump. | Reduce backpressure. |
| | Pump may not be sized correctly for process. | Replace pump. |
| | Pump impeller is too small. | Change pump impeller but watch power consumption on motor. |
| | Flow control valve is closed. | Open flow control valve. |
| | May have blocked line or filter. | Replace filter and clean line. |

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|---|---|---|
| Pump is making excessive noise during operation. | Manually rotate pump impeller and listen for clearance problems. | Disassemble pump and fix clearance problems. |
| | Alignment of pump may be off causing the flexible coupling to degrade. | Check alignment and reset alignment if needed. Replace flexible coupling if it is degraded. |
| **Liquid Ring Pump** | | |
| Pump does not produce enough vacuum. | Pump is not primed. | Prime pump and start under vacuum. |
| | Service fluid is to low in seal oil tank. | Add seal oil. |
| | No restriction on inlet of pump. | Close valves to create suction. |
| | Dilution valve is open. | Close dilution valve. |
| | Service fluid is not flowing into the pump. | Check for flow restrictions in service fluid lines. Check strainer. |
| | Pump is rotating in the wrong direction. | Check and change direction if required. |
| | Vacuum gauge is not working correctly. | Replace vacuum gauge. |
| | Pump seals may be allowing air into the pump. | Check for leaking and replace seals if required. |
| | Pump is too small for application. | Replace pump. |
| | Vacuum relief valve is set too low. | Replace or reset vacuum relief valve. |
| | Air may be leaking into vapor lines. | Check for air leaks in vapor lines. |
| | Pump internal components are damaged. | Disassemble pump and replace components if required. |
| Pump is making a growling noise. | Cavitation is occurring. | Decrease the vacuum. |
| | Insufficient seal fluid flow or excessive seal fluid flow. | Increase/decrease seal fluid flow rate. |
| Pump is leaking. | Gaskets are faulty. | Replace gaskets. |
| | Mechanical seal has been overheated or is faulty. | Replace mechanical seal. |
| | Oil may be leaking from 1/8" vacuum relief valves in pump housing. | Remove valves and install plugs. |
| Pump is running too hot. | Seal fluid strainer is plugged restricting seal fluid. | Clean out strainer. |
| | LRP is not providing enough suction to draw sufficient seal fluid. | Increase seal oil suction. Pipe seal fluid into a higher vacuum port of pump. |

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| | Seal fluid flow rate is too low. | Open seal fluid control valve to allow more seal fluid to enter the pump. |
| | Seal fluid heat exchanger is not working properly. | Check heat exchanger. |
| Excessive discharge pressure built up in seal oil tank. | Demister filter is plugged and requires replacement. | Replace demister. |
| | Seal oil is not being drawn out of demister filter through scavenger line. | Increase vacuum of LRP to allow oil to be sucked through scavenger line. Ensure that scavenger line has sufficient vacuum to draw oil out of the demister filter. |
| Seal Oil Low Level Alarm | Seal oil temperature may be operating too high causing the oil to evaporate. | Check seal oil operating temperature and increase seal oil flow. |
| | Seal oil suction line may be plugged causing seal oil to collect in bottom of demister filter. | Check for plugging of seal oil return line and clean or replace if required. |
| **Air to Air and Air to Fluid Heat Exchangers** | | |
| Heat exchanger fan is drawing too many amps. | See troubleshooting for motors. | |
| | Fan blade pitch and diameter may be wrong. | Change fan blade. |
| | Motor may be operating at wrong RPM for fan blade. | Replace motor or fan blade. |
| | Check clearance of fan blade. | Make adjustments if blade is making contact. |
| **Phase Separator** | | |
| Water will not pump out of phase separator. | Base of separator may be plugged with sand. | Flush sand and debris out of separator. |
| **Electric Solenoid Valve** | | |
| Valve will not completely shut. | May have dirt or rocks preventing it from shutting properly. | Disassemble and clean out internal components. |
| Valve will not open | Check for power to solenoid. | Trace power lines and determine why power is not going to valve. |
| | PLC may not be telling it to open. | Check start requirements in manual. |
| | Coil may be damaged or faulty. | Replace coil. |
| **Level Switches** | | |
| Level switch is staying closed when water in tank drops below switch. | Level switch is upside down or on its side. | Check orientation of level switch. Level switch may be designed as normally closed and therefore will be upside down. |

| | | |
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| | Sight glass is plugged giving a false level in the tank. | Clean sight glass. |
| | Level switch has dirt or film causing it to stick up. | Remove level switch, clean and test for normal operation using a millimeter. |
| | Level switch may be damaged or faulty and failed closed regardless of the switch position. | Replace switch. |
| | Wiring to level switch may be shorting out to ground causing the switch to appear closed at all times. | Disconnect switch from system wiring and separate system wires so they are not in contact with each other or any metal. If the input is still on, the input wiring is being grounded somewhere. Find short and replace or fix wiring. |
| | IS barrier is shorted out internally. | Switch IS barrier with working barrier and if problem goes away then the barrier may be faulty and should be changed. |
| | Input wiring is loose in terminal strip. | Tighten terminal strip where field wiring is brought into panel. |
| | Level switch is wired incorrectly. | Consult input wiring diagram and inspect wiring of level switch. Change if required. |
| Level switch stays open when water in tank is above the switch. | Level switch is upside down or on its side. | Check orientation of level switch. Level switch may be designed as normally closed and therefore will be upside down. |
| | Sight glass is plugged giving a false level in the tank. | Clean sight glass. |
| | Level switch has dirt or film causing it to stick down. | Remove level switch, clean and test for normal operation using a millimeter. |
| | Level switch may be damaged or faulty and failed open regardless of the switch position. | Replace switch. |
| | IS barrier is blown preventing the level switch signal from crossing the barrier. | Switch IS barrier with working barrier and if problem goes away then the barrier may be blown. If barrier is blown, the input wire on the right side of the barrier will have 24 V DC and the wire on the opposite side will have 0V DC. |
| | Level switch is wired incorrectly. | Consult input wiring diagram and inspect wiring of level switch. Change if required. |

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| **Regenerative Blowers** | | |
| Blower does not produce sufficient pressure/vacuum. | Blower is not turned on. | Turn on blower. |
| | Wrong direction of rotation. | Check and change rotation if required. |
| | Vacuum or pressure gauge is faulty. | Replace gauge. |
| | Blower is not operating at required RPM. | Check and replace motor if required. |
| | Blower has wrong sized impeller. | Check impeller and replace if required. |
| | Pressure or vacuum is lost due to obstruction located between blower and gauge. | Check for flow restrictions and clean strainers or piping if required. |
| Blower is leaking. | Fittings are leaking on or around blower. | Tighten fittings. |
| Blower flow rate is too low. | Backpressure is too high for blower. | Reduce backpressure. |
| | Blower may not be sized correctly for process. | Replace blower. |
| | Blower impeller is too small. | Change blower impeller but watch power consumption on motor. |
| | Flow control valve is closed. | Open flow control valve. |
| | May have blocked line or filter. | Replace filter and clean line. |
| **Air Stripper** | | |
| Stripper leaks. | Gaskets are leaking. | Apply silicon grease to gaskets and close up stripper. If they cannot be fixed the gaskets may need to be replaced. |
| Pressure or vacuum is building up in stripper. | Stripper is being fouled by mineral precipitates. | Clean stripper with acid to dissolve precipitates. |
| | Airflow rate through stripper has risen or is above the design value. | Decrease airflow rate. |
| Stripper is not cleaning contaminants sufficiently. | Inlet concentrations are higher than the design values. | Decrease water flow rate to obtain required stripping capacity. |
| | Flow rate of water through stripper is too high. | Decrease flow rate allowing longer residence time in stripper. |
| | Water temperature is lower than the design (below 60°F). | Increase water temperature or slow down water flow rate or increase airflow rate. |
| | Airflow rate is not high enough. | Increase airflow rate or decrease water flow rate. |

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| | Products that are not easily strippable may be in higher concentrations than originally planned. | Consult manufacturer with test results of discharge contaminants. |
| | Stripper may have been shut down manually causing the contaminated water in the trays to fall into the sump without being cleaned. | Allow stripper to go through proper shutdown cycle when stopping the unit. |
| | Stripper may be setup wrong allowing the water to bypass trays. | Check orientation of trays to ensure water will flow through each tray properly. |
| | Some contaminants may be present that are affecting the ability to strip other contaminants. | Consult manufacturer with test results of intake and discharge contaminants. |
| | Increase in pressure causes a decrease in airflow resulting in a decrease of contaminant concentrations. | See pressure rise in stripper troubleshooting above. |
| Water is collecting in discharge piping of stripper. | Air leaving the stripper is very humid and will condense some water in the pipelines. | Install a knockout drum in discharge line before air is piped to another section of the process. |
| | The stripper causes foaming of the water which results in water collecting in the discharge lines. | Test for foaming contaminants such as soaps and install antifoaming dosing system to prevent foaming. |
| | Airflow rate is higher than the design value causing water to be carried over into the discharge lines. | Decrease flow rate to within design range. |
| Stripper often shuts down on a high stripper sump alarm. | Transfer pump is flowing faster than the discharge pump. | Slow transfer pump or speed up discharge pump. |
| | Discharge pump is not working properly. | Troubleshoot discharge pump. |
| **Moyno Pumps** | | |
| Pump does not produce sufficient pressure/vacuum. | Pump is not primed. | Prime pump. |
| | Wrong direction of rotation. | Check and change rotation if required. |
| | Vacuum or pressure gauge is faulty. | Replace gauge. |
| | Pump is not operating at required RPM. | Check and replace motor if required. |
| | Pump has wrong sized impeller. | Check impeller and replace if required. |
| | Pump pressure or vacuum is lost due to obstruction located between pump and gauge. | Check for flow restrictions and clean strainers or piping if required. |

| | | |
|---|---|---|
| | Pump is not turned on. | Turn pump on. |
| | Coupling between pump and motor is no longer connected preventing the pump from rotating with the motor. | Reconnect and realign motor and pump. |
| Pump is leaking. | Gaskets are worn or faulty. | Replace gaskets. |
| | Mechanical seal has been overheated. This is often a result of operating the pump without any water. | Replace mechanical seal. |
| | Fittings are leaking on or around pump. | Tighten fittings. |
| | Water may be coming from another location. | Check for leaks around pump. |
| | Pump was run in reverse allowing the rotor to spin off of the pump shaft. | Disassemble pump and screw rotor back onto shaft (See manufacturer's manual). |
| Pump flow rate is too low. | Backpressure is too high for pump. | Reduce backpressure. |
| | Pump may not be sized correctly for process. | Replace pump. |
| | Pump impeller is too small. | Change pump impeller but watch power consumption on motor. |
| | Flow control valve is closed. | Open flow control valve. |
| | May have blocked line or filter. | Replace filter and clean line. |
| Pump is making excessive noise during operation. | Manually rotate pump impeller and listen for clearance problems. | Disassemble pump and fix clearance problems. |
| | Alignment of pump may be off causing the flexible coupling to degrade. | Check alignment and reset alignment if needed. Replace flexible coupling if it is degraded. |
| **Pressure Switch/Vacuum Switch** | | |
| Switch is not reacting at desired set point. | Switch is out of adjustment. | Change set point to desired value. |
| Switch is not working. | Switch may be faulty. | Remove input wires and test switch at desired pressure. If it does not trigger, it should be replaced. |
| **Flow meter** | | |
| Flow meter is not rotating. | Dirt could have caused meter internals to jam up. | Disassemble flow meter and clean internal components. |
| Flow meter is rotating but pulse input is not working. | Switch on meter may be faulty. | Remove wiring and test contacts on meter to ensure that they are opening and closing. If not meter head needs to be replaced. |

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| | Input wiring may be grounding out preventing the signal from opening and closing. | Test input wiring by isolating input wires and checking if input is on. If so you have a grounded input wire. |
| | Input to PLC is not working. | Simulate rotating meter by contacting input wires together and check for a detected flow rate and change in totalized flow |
| **Belt Driven Assemblies** | | |
| Squealing noise occurs on startup. | Belt is too loose. | Check tension of belt and tighten if required. |
| Excessive wear on bearings. | Belt is too tight. | Loosen belt tension. |
| Belt is wearing excessively. | Check orientation of blower and motor. | Adjust orientation if required. |
| **Carbon Vessel** | | |
| Vessel is operating over pressure. | Silt may have collected in water phase vessel. | Remove lid and check for silt. Remove top layer of silt or replace vessel. |
| Vessel is breaking through earlier than expected. | Flow rate through vessel may be too high. Check design specifications. | Decrease flow rate. |
| | Air contaminant concentrations are higher than expected. | Test inlet concentrations. |
| | Check piping orientation to ensure that water is going in the top of water phase vessels and air is going in the bottom of air phase vessels. | Repipe vessel if piping is wrong. |
| | Ensure that there is not a large trapped air gap in the top of the water phase carbon vessel allowing the water to bypass a portion of the carbon. | Release air gap if present. |
| **Bag Filter** | | |
| Vessel is operating over pressure. | Bag filter may be full of dirt and silt. | Remove cover and check for dirt buildup in the bag. Replace filter element if required. |
| | Equipment down stream of bag filter may be plugging. | Check for pressure buildup down stream of filter and fix pressure buildup downstream if found. |
| Water will not flow through filter fast enough. | Pump may not be able to supply enough pressure. | Check pressure output of pump with pump curve. Replace pump if needed. |
| Filters are plugging too fast. | Filter element micron size may be too low. | Install larger micron filter element. |

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| | Filter pressure switch setpoint may be too low. | Increase high pressure shutdown setpoint. |
| **Oil Water Separator** | | |
| Water is collecting in product tank | Oil water separator may not be level causing water to spill into the skimmer tube. | Check level of oil water separator and adjust if necessary. |
| | Skimmer tube is not adjusted properly. | Check position of skimmer tube ensure that tube is rotated so the skimming slot allows at least 1-2" of oil to collect before spilling over into the oil tank. |
| | Skimmer tube is cracked or leaking. | Check that skimmer tube is not cracked, replace if necessary. |
| | Separator can be full of sludge on the bottom restricting water flow through to the clean water reservoir. | Check for dirt buildup in bottom. Drain and clean separator if necessary. |
| Oil is collecting on the clean water side | Oil water separator may be operating outside of design parameters. | Check that specific gravity of product and flow rate of separator match site-specific design print out for oil water separator. This can be found in the oil water separator section of your **newterra** manual or submittal package. |
| | Oil water separator was not primed with clean water on startup and large amounts of product were initially pumped into separator contaminating the clean water sections. | Drain separator, clean separator and media, and fill with clean water before proceeding. |
| | Silt can build up in the bottom of the separator restricting volume capacity and flow through media. | Inspect bottom of separator and inside of media. Drain and clean separator and clean or replace media if plugged or restricted. |
| | Inlet side of separator can have excessive amounts of oil on the top layer. This will reduce effective capacity of oil water separator. | Check level of oil collected in inlet side of separator. Adjust skimmer if required. Re-prime separator so only 1-2" of product remains on the top of the separator. |
| | Biological bacteria is suspending product in high-density mucus like collections that are passing through the separator. | Check for signs of bacteria in the inlet side of the separator. Contact **newterra** to discuss solutions to eliminating biological suspension. |
| | Product may be made up of two different components. The component breaking through may have a different density from what the separator was designed for. | Collect a sample of what is breaking through and confirm that it has the same properties as the product collecting on the inlet side. |

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|---|---|---|
| | Oil storage tank may be full and high-level alarm not working properly. This will back the product up and fill the inlet side of the separator with product until the product passes under the lower weir and collects in the clean-water side. | Check product storage tank and ensure that level switch is working properly and that tank has not overfilled. |
| Oil and water is building up on inlet side but is not passing through separator and collecting in the clean water side. | Sludge and dirt may have built up on floor of separator preventing the water from passing by the lower weir. | Check for dirt buildup on bottom of separator. Drain and clean if necessary. |
| | Oil Water interface may be too low indicating that the separator has insufficient water to properly separate. | Fill the separator with clean water allowing water to collect in the inlet side forcing the oil water interface level to rise up too about 1" - 2" below the skimmer level. |
| | Only product is being pumped into inlet of separator. | If water is not present in sample entering the separator then it will not collect in the clean water side. |
| Water is in the oil outlet. | Skimmer opening is below the oil/water interface. | Adjust skimmer alignment to allow more oil to collect before skimming. |
| Oil is making its way to the outlet. | Water flow rate is too high. | Reduce flow rate through system. |
| | Filter media is plugged. | Replace or clean media. |
| | Oil discharge is plugged backing up OWS. | Drain oil down stream of skimmer. |
| **Sand Filter** | | |
| Vessel is operating over pressure. | Sand filter may be full of dirt and silt. | Remove cover and check for dirt buildup on top of filter. Backwash filter. |
| | Equipment down stream of sand filter may be plugging. | Check for pressure buildup down stream of filter and fix pressure buildup downstream if found. |
| Water will not flow through filter fast enough. | Pump may not be able to supply enough pressure. | Check pressure output of pump with pump curve. Replace pump if required. |
| Filters are plugging too fast. | Filter was not backwashed properly. | Backwash filter vessel as per manufacturer's instructions. |
| | Filter pressure switch setpoint may be too low. | Increase high-pressure shutdown setpoint. |
| | Filter sand has solidified with calcification. | Replace sand in filter. |

| | | |
|---|---|---|
| | Process water flow rate is operating above the design flow rate for the sand filter. | Check process flow rate and compare with design flow rate listed on manufacturer's literature or on the component sheet of the sand filter section of your **newterra** Manual. |
| **Rotary Screw Compressor Package** | | |
| Compressor not starting. | Motor Overload. | Reset overload.<br>Check compressor output pressure. Oil separator may be dirty, replace if needed.<br>Check supply voltage. |
| | Stopped by compressed air temperature relay. | Oil level is too low.<br>Not enough cooling air flow.<br>Wrong compressor oil.<br>Ambient temperature too high.<br>Cooler dirty. |
| Insufficient air output. | Clogged intake filter. | Check condition of the filter and replace if needed. |
| | Clogged oil separator element. | Check condition of the oil separator element and replace if needed. |
| | Pressure switch is not working. | Check pressure switch adjustment. Repair or replace if switch is faulty. |
| | Receiver blow down valve open. | Disassemble and clean out internal components. |
| | Too high air consumption. | Check network for leaks and air powered devices. |
| | Drive belt slipping. | Check tension of belt and tighten if required. Replace belt if worn. |
| Compressor overheating. | Insufficient amount of oil. | Add more oil. |
| | Clogged oil filter. | Check condition of the filter and replace if needed. |
| | Cooler dirty. | Clean. |
| | Ambient temperature too high. | Check temperature and air circulation. |
| High oil consumption. | Oil return tube or its orifice is blocked. | Open and clean all internal components. |
| | Oil separator or sealing damaged or loosened. | Check seals and repair if needed. |
| | Oil separator dirty. | Replace. |
| | Wrong compressor oil | Change oil. Use the correct oil as specified in the manufacturer's instructions. |
| | Output air temperature too high. | Check output temperature correct if it is too high. |

| | | |
|---|---|---|
| | Faulty non-return valve of oil return pipe. | Check operation and replace valve if needed. |
| | Too much oil. | Drain extra oil out. |
| Network pressure rises over set valve. | Pressure switch is not working or damaged. | Check operation of switch. |
| | Output valve leaking. | Replace seal. |
| | Loose wire connections. | Check for loose wires and correct as needed. |
| Compressor doesn't restart automatically. | Pressure switch damaged. | Replace pressure switch. |
| | Output valve leaks. | Replace seals of output valve. |
| | Loose wires. | Check for loose wires and correct as needed. |
| Compressor doesn't stop automatically. | Output valve leaks. | Replace seals of output valve. |
| | Pressure Switch Damaged. | Replace pressure switch. |
| **Refrigerated Dryer** | | |
| Water down stream of dryer. | Residual air in piping. | Blow out system with dry air. |
| | Air bypass system is open. | Check the bypass valve position. |
| | Inlet and Outlet conditions are reversed. | Check for correct connection. |
| | Air temperature on outlet of dryer may be too low. | Add heat trace to piping. |
| | Automatic drain mechanism is not working. | Replace drain mechanism. |
| | Dryer overloaded. | Check flow rate and inlet temperature. |
| High pressure drop across dryer. | Inlet air strainer clogged. | Clean inlet air strainer. |
| | Excessive air flow. | Check flow rate and reduce if needed. |
| | Separator filter clogged. | Replace filter sleeve. |
| | Freezing of moisture in evaporator. | Shut down dryer until system thaws. |
| Fault Alarm. | Dryer overloaded resulting in high air outlet temperature. | Check operating conditions. |
| | High outlet air temperature. | Correct high temperature. |
| | Thermostat switch is malfunctioning or not securely mounted. | Replace thermostat switch. |
| Refrigeration system not functioning properly in on position. | Power failure. | Check power. |
| | Line disconnect switch is open. | Check disconnect. |

| | | |
|---|---|---|
| | Fuses blown, breaker blown. | Check fuses or breaker. |
| | Loose or faulty wiring. | Check wiring. |
| Refrigeration system cycles on and off. | High or low ambient conditions. | Check min/max temperature ranges. |
| | Air filter clogged. | Clean filter. |
| | Condenser fins clogged. | Clean fins. |
| | Fan motor or control switch not working. | Replace fan motor or switch. |

| | | |
|---|---|---|
| **Analog 4-20mA Transmitters** | | |
| Transmitter is sending a signal that is not accurate. | There may be water in the air sampling lines that is throwing off the readings. | Drain any moisture out of the air sampling lines. |
| | Transmitter may be out of calibration. | Refer to transmitter specification sheets on how to calibrate the transmitter. Note if transmitter is more than 10-25% out of calibration it will likely require factory recalibration. |
| Transmitter is sending 0-2 mA to the PLC input. | Transmitter may not be wired properly or one or more wire connections may be loose. | Check wiring with device specification sheet and **newterra** drawing. Check wiring for loose connections. |
| | Transmitter may be damaged or not working properly. | If you have a similar transmitter installed in another location on the system, switch them around to determine if the faulty transmitter works in another location. If the transmitter works you know the transmitter is not the problem. If the transmitter does not work in the other location then it is likely the transmitter. If the good transmitter does not work in the faulty location the problem is likely the wiring at that location or the input into the PLC. |
| Transmitter is sending over 20 mA to the PLC. | Transmitter is likely damaged. | Send back to manufacturer for re-calibration. |
| **PLC's** | | |
| Power is on, Lights are on but PLC is not running the logic. Run light is not on. | PLC may not be in run mode. If the power has been off to the panel for an extended period of time, the PLC will switch out of run mode and stop running the logic. | Use external switch on PLC to switch from "term" to "run" then back to "term". This will force the PLC back into run mode. The run light should now indicate that the PLC is in run mode. |
| Power is on to panel but PLC lights are not on. | Fuse for PLC is pulled out or blown. | Test PLC fuse and replace if necessary. This is in the "PLC" fuse holder. |

# APPENDIX B –

# OWS COMMISSIONING JOB HAZARD ANALYSIS (JHA)

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# Job Hazard Analysis Form

| PROJECT/TASK: Commissioning Mobile OWS | | CONTRACTOR: BIM | | | | JOB No.: | | | |
|---|---|---|---|---|---|---|---|---|---|
| SUPERVISOR: | | LOCATION: | | | | DATE: | | | |
| **JOB STEP**<br>Break the job into steps.<br>Listing work which may be hazardous. | **HAZARDS**<br>List the hazard or type of harm identified with each step. | **Inherent** | | | **CONTROL MEASURE**<br>List the necessary control measures to be followed to eliminate/reduce the identified hazards. | **Residual** | | | **ACTION**<br>Person who will ensure this happens |
| | | Consequence | Likelihood | Risk Ranking | | Consequence | Likelihood | Risk Ranking | |
| Opening Media canisters | Potential built up gases | | | | Technicians will use appropriate PPE and wear Gas Tester alarm systems while opening GAC canisters and opening vent ports. | | | | |
| Vacuum Media from OWS | Vacuum line inside OWS area | | | | Operators/technician will open valve and ensure system is operating properly before working inside OWS canisters | | | | |
| | Potential for inhalation of carcinogenic particulate being disturbed | | | | Respirators will be worn while disturbing spent bentonite and GAC to avoid inhalation of particulate | | | | |
| | Working from a ladder or raised platform | | | | Work platform or ladder will be tested for stability before working with vacuum line to remove media | | | | |
| Discharge or Vacuum to/from an open vessel | Working with pressurized hoses | | | | When completing discharge, pressure is released, 3” opened, and the line will be vacuumed out. | | | | |
| | | | | | Open end must always be controlled – | | | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | braced by operator, or in a bracket. | | | | |
| | Potential for inhalation of carcinogenic particulate being disturbed | | | | Respirators will be worn while disturbing spent bentonite and GAC to avoid inhalation of particulate | | | | |
| Installing new media | Working from heights | | | | Scaffolding will be present to ensure platform and railing to prevent falling. | | | | |
| | Heavy lifting at heights | | | | Telehandler will need to be used to remove pallets of media from Sea Cans and onto OWS roof so bags of media are within reach of the scaffolding and railing system | | | | |
| | Potential for inhalation of carcinogenic particulate being disturbed | | | | Respirators will need to be worn while pouring media through roof ports into canisters to prevent inhalation of particulate | | | | |
| Commissioning new media | Working with pressurized hoses | | | | A water truck operator will need to hook up line to tanks and fill through influent port in first media canister until fresh water comes out the effluent line into the berm. | | | | |

**Job Hazard Analysis Attendees:**

| | Name | Signature | Date |
|---|---|---|---|
| **Written by:** | | | |
| **Reviewed by:** | | | |


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| Score | TABLE OF CONSEQUENCE | | |
|---|---|---|---|
| | **People** | **Plant** | **Environment** |
| **5 – Very High/ Catastrophic** | Multiple Fatalities. | Greater than $10 Million Loss | Catastrophe, destruction of sensitive environment, worldwide attention. Likely EPA prosecution. More than 30 days delay. |
| **4 – High/ Major** | Fatality or Permanent Disabilities. | $1 Million to $10 Million Loss | Disaster, high levels of media attention, high cost of clean up. Offsite environmental harm; more than 10 days delay. |
| **3 – Moderate** | Major Injuries – Incapacitations or requiring time of work. | $100 Thousand to $1 Million Loss | Major spills, onsite release, substantial environmental nuisance, more than 1day delay. (Leads to an additional resources call out i.e. SES). |
| **2 – Low/ Minor** | Significant Injuries – Medical Treatments, non-permanent injury. | $10 Thousand to $100 Thousand Loss | Significant spills. (Leads to a call out of Site Emergency Response Group). |
| **1 – Very Low/ Insignificant** | Minor Injuries – First Aid Treatments (cuts/bruises). | Less than $10 Thousand Loss | Low environmental impact. Minor Spills less than 80 Litres. |

| Score | LIKELIHOOD |
|---|---|
| **5 – Almost Certain** | The event is expected to occur in most circumstances. Likely to occur frequently - More than 1 per year. |
| **4 – Likely/ Probable** | The event will probably occur in most circumstances. Likely to occur several times – 1 per year. |
| **3 – Moderate/ Occasional** | The event should occur at some time. Likely to occur some time – 1 per 5 years. |
| **2 – Remote/ Unlikely** | The event could occur at some time. Unlikely but possible. 1 per 10 years. |
| **1 – Rare/ Very Unlikely** | The event may occur only in exceptional circumstances. Assumed it may not be experienced. 1 per 100 years. |

**Risk Rating = Consequence + Likelihood**

| Consequence | Risk Rating | | | | |
|---|---|---|---|---|---|
| **5** | **6** | **7** | **8** | **9** | **10** |
| **4** | **5** | **6** | **7** | **8** | **9** |
| **3** | **4** | **5** | **6** | **7** | **8** |
| **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | **2** | **3** | **4** | **5** | **6** |
| | **1** | **2** | **3** | **4** | **5** |
| | **Likelihood** | | | | |

**Risk Rating - Definitions**

| Risk Rating | Definitions | *Action Required* |
|---|---|---|
| 8 - 10 | Intolerable | Task not to start till the risk is eliminated or reduced. Bring to the immediate attention of management. Formal assessment required. MUST reduce the risk as a matter of priority. |
| 7 | High | Bring to the immediate attention of management. Task not to start till the risk is eliminated or reduced. Further Assessment required. MUST reduce the risk as a matter of priority. |
| 6 | Significant Risk | Bring to the attention of supervision. Review risks and ensure that they are reduced to as low as reasonably practicable. To be dealt with as soon as possible, preferably before the task commences. Introduce some form of hardware to control risk. |
| 5 | Moderate Risk | Needs to be controlled but not necessarily immediately, an action plan to control the risk should be drawn up. Review effectiveness of controls. Ensure responsibilities for control are specified. |
| 2-4 | Low Risk | If practical reduce the risk. Ensure personnel are competent to do the task. Manage by routing procedure. Monitor for change |

**A JHA considers a variety of activities/tasks involved in a job scope and analyses the key hazards (sources of harm) and their consequences (types of harm) eg. Sources of harm – lifting a heavy pipe - manual handling. Types of harm – Back strain.**



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### *Main Points – On how to write a JHA.*

1. Define the task – what is to be done.
2. Review previous JHA if any – have we done it before?
3. Identify the steps – what is to be done.
4. Identify the hazards of each step.
5. Identify who or what could be harmed.
6. Give the task a risk rating – Consequence + Frequency
7. Develop solutions to eliminate or control hazards in each step.
8. Review the risk rating after the control system has been implemented.
9. If risk rating unacceptable review the solutions till risk rating acceptable.
10. Agree who will implement the control system.
11. Document the JHA and discuss with the relevant personnel.

### *Hierarchy of Hazard Management – Control Measures*

These steps outline what should be planned for when deciding what control measures are to be put in place. Whenever possible the highest step should be used first and then progress down the list.

1. Eliminate the hazard.
2. Substitution.
3. Reducing the frequency of a hazardous task.
4. Enclosing the hazard.
5. Additional procedures.
6. Additional supervision.
7. Additional training.
8. Instructions / information.
9. Some personal protective equipment.



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# APPENDIX C –

# OWS OPERATIONS JOB HAZARD ANALYSIS


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Note: This is an UNCONTROLLED COPY. All staff members are responsible to ensure the latest revision is used.

# Job Hazard Analysis Form

| PROJECT/TASK: Operating OWS | | CONTRACTOR: BIM | | | | JOB No.: | | | |
|---|---|---|---|---|---|---|---|---|---|
| SUPERVISOR: | | LOCATION: | | | | DATE: | | | |
| **JOB STEP**<br>Break the job into steps.<br>Listing work which may be hazardous. | **HAZARDS**<br>List the hazard or type of harm identified with each step. | **Inherent** | | | **CONTROL MEASURE**<br>List the necessary control measures to be followed to eliminate/reduce the identified hazards. | **Residual** | | | **ACTION**<br>Person who will ensure this happens |
| | | Consequence | Likelihood | Risk Ranking | | Consequence | Likelihood | Risk Ranking | |
| Starting System | Leaks of fuel or contaminated water | | | | Operator will address all active alarms. | | | | |
| | Energized equipment failure | | | | Pre inspection of all electrical equipment and pumps. | | | | |
| | Skin contact with contaminated water | | | | Wear hip waiters and rubber gloves when installing sump in berm | | | | |
| Operating system | Exceeding maximum pressure in pumps and tanks | | | | Operators/technician monitor all pressure valves and shut down system if any exceedances occur. | | | | |
| | Leaks of fuel or contaminated water | | | | Continuously monitor all lines and fittings to make sure they are secured properly | | | | |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Slips, trips and falls<br><br>Congested work area | | | | Proper footwear, be aware of surroundings<br><br>Communicate with other occupants, be aware of all valves and hoses when walking through seacan | | | | |

**Job Hazard Analysis Attendees:**

| | Name | Signature | Date |
|---|---|---|---|
| **Written by:** | | | |
| **Reviewed by:** | | | |



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| Score | TABLE OF CONSEQUENCE | | |
|---|---|---|---|
| | **People** | **Plant** | **Environment** |
| **5 – Very High/ Catastrophic** | Multiple Fatalities. | Greater than $10 Million Loss | Catastrophe, destruction of sensitive environment, worldwide attention. Likely EPA prosecution. More than 30 days delay. |
| **4 – High/ Major** | Fatality or Permanent Disabilities. | $1 Million to $10 Million Loss | Disaster, high levels of media attention, high cost of clean up. Offsite environmental harm; more than 10 days delay. |
| **3 – Moderate** | Major Injuries – Incapacitations or requiring time of work. | $100 Thousand to $1 Million Loss | Major spills, onsite release, substantial environmental nuisance, more than 1day delay. (Leads to an additional resources call out i.e. SES). |
| **2 – Low/ Minor** | Significant Injuries – Medical Treatments, non-permanent injury. | $10 Thousand to $100 Thousand Loss | Significant spills. (Leads to a call out of Site Emergency Response Group). |
| **1 – Very Low/ Insignificant** | Minor Injuries – First Aid Treatments (cuts/bruises). | Less than $10 Thousand Loss | Low environmental impact. Minor Spills less than 80 Litres. |

| Score | LIKELIHOOD |
|---|---|
| **5 – Almost Certain** | The event is expected to occur in most circumstances. Likely to occur frequently - More than 1 per year. |
| **4 – Likely/ Probable** | The event will probably occur in most circumstances. Likely to occur several times – 1 per year. |
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| **1 – Rare/ Very Unlikely** | The event may occur only in exceptional circumstances. Assumed it may not be experienced. 1 per 100 years. |

**Risk Rating = Consequence + Likelihood**

| Consequence | Risk Rating | | | | |
|---|---|---|---|---|---|
| **5** | **6** | **7** | **8** | **9** | **10** |
| **4** | **5** | **6** | **7** | **8** | **9** |
| **3** | **4** | **5** | **6** | **7** | **8** |
| **2** | **3** | **4** | **5** | **6** | **7** |
| **1** | **2** | **3** | **4** | **5** | **6** |
| | **1** | **2** | **3** | **4** | **5** |
| | **Likelihood** | | | | |

**Risk Rating - Definitions**

| Risk Rating | Definitions | *Action Required* |
|---|---|---|
| 8 - 10 | Intolerable | Task not to start till the risk is eliminated or reduced. Bring to the immediate attention of management. Formal assessment required. MUST reduce the risk as a matter of priority. |
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| 6 | Significant Risk | Bring to the attention of supervision. Review risks and ensure that they are reduced to as low as reasonably practicable. To be dealt with as soon as possible, preferably before the task commences. Introduce some form of hardware to control risk. |
| 5 | Moderate Risk | Needs to be controlled but not necessarily immediately, an action plan to control the risk should be drawn up. Review effectiveness of controls. Ensure responsibilities for control are specified. |
| 2-4 | Low Risk | If practical reduce the risk. Ensure personnel are competent to do the task. Manage by routing procedure. Monitor for change |

**A JHA considers a variety of activities/tasks involved in a job scope and analyses the key hazards (sources of harm) and their consequences (types of harm) eg. Sources of harm – lifting a heavy pipe - manual handling. Types of harm – Back strain.**



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### *Main Points – On how to write a JHA.*

1. Define the task – what is to be done.
2. Review previous JHA if any – have we done it before?
3. Identify the steps – what is to be done.
4. Identify the hazards of each step.
5. Identify who or what could be harmed.
6. Give the task a risk rating – Consequence + Frequency
7. Develop solutions to eliminate or control hazards in each step.
8. Review the risk rating after the control system has been implemented.
9. If risk rating unacceptable review the solutions till risk rating acceptable.
10. Agree who will implement the control system.
11. Document the JHA and discuss with the relevant personnel.

### *Hierarchy of Hazard Management – Control Measures*

These steps outline what should be planned for when deciding what control measures are to be put in place. Whenever possible the highest step should be used first and then progress down the list.

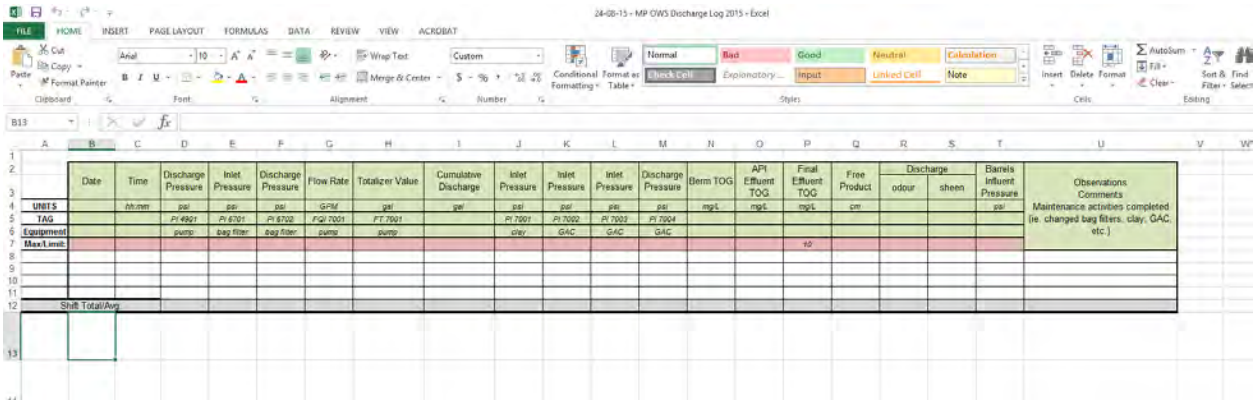
1. Eliminate the hazard.
2. Substitution.
3. Reducing the frequency of a hazardous task.
4. Enclosing the hazard.
5. Additional procedures.
6. Additional supervision.
7. Additional training.
8. Instructions / information.
9. Some personal protective equipment.



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# APPENDIX D –

# OWS DISCHARGE LOG - DAILY LOG SHEET



| Date | Time | Discharge Pressure | Inlet Pressure | Discharge Pressure | Flow Rate | Totalizer Value | Cumulative Discharge | Inlet Pressure | Inlet Pressure | Inlet Pressure | Discharge Pressure | Berm TOG | API Effluent TOG | Final Effluent TOG | Free Product | Discharge | | Barrels Influent Pressure | Observations Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | odour | sheen | | |
| UNITS | hh:mm | psi | psi | psi | GPM | gal | gal | psi | psi | psi | psi | mg/L | mg/L | mg/L | cm | | | psi | Maintenance activities completed (ie. changed bag filters, clay, GAC, etc.) |
| TAG | | PI 6901 | PI 6701 | PI 6702 | FQI 7001 | FT 7001 | | PI 7001 | PI 7002 | PI 7003 | PI 7004 | | | | | | | | |
| Equipment | | pump | bag filter | bag filter | pump | pump | | clay | GAC | GAC | GAC | | | | | | | | |
| Max/Limit | | | | | | | | | | | | | | 15 | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| Shift Total/Avg | | | | | | | | | | | | | | | | | | | |

Electronic file located on Mine Site Environmental Server:

FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators


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# APPENDIX E –

# BOTTLE SET REQUIREMENTS FOR SAMPLING STATIONS

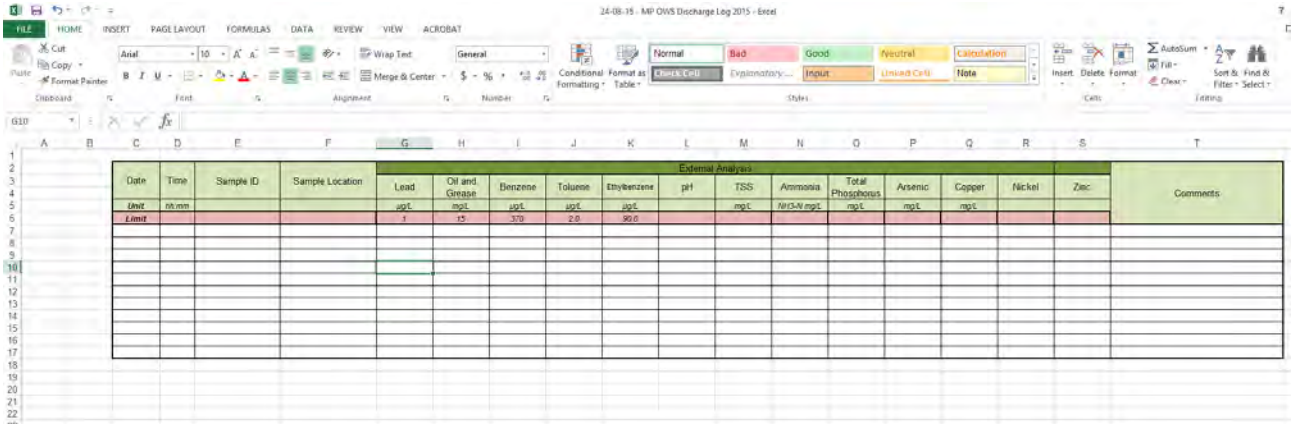
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| Monitoring Group | Station | | | Parameters | Bottles | Total Bottles | Notes |
|---|---|---|---|---|---|---|---|
| **Group 1** | All water taking and discharge | | | Water withdrawal/discharge volumes in cubic meters | | | Daily |
| **Group 2** | MS-01<br>MS-01a | MP-01<br>MP-01a | SP-01<br>SP-01a | pH, TSS<br>alkalinity, BOD<br>TKN, N-NH3, TP, COD<br>O&G<br>Faecal coliforms (effluent only) | 1 x 1L Plastic or glass for on site analysis of pH and TSS<br>1 x 1L Plastic for alkalinity, BOD<br>1 x 250mL glass with H2SO4 preservative for NH3, TKN, TP, COD<br>2 x 500mL glass with HCL preservative for Oil & Grease<br>1 x 300mL sterile PET with sodium thiosulfate filled to shoulder for feacal coliforms | 6 Effluent<br>5 Influent | On Site |
| **Group 3** | MS-01<br>MS-01a<br>MS-MRY-04<br>MS-MRY-04a<br>MS-06+<br>MS-07<br>MS-08<br>MS-09<br>MS-MRY-09<br>MS-MRY-10<br>MQ-C | MP-01<br>MP-01a<br>MP-Q1 | SP-01<br>SP-01a<br>SP-03<br>SP-07 | Acute Toxicity | 1 x 20L pail<br>a. Acute lethality to Rainbow Trout, *Oncorhynchus mykiss* (as per Environment Canada's Environmentla Protection Series Biological Test Method EPS/1/RM/13)<br>b. Acute lethality to *Daphnia magna* (as per Environment Canada's Environmentla Protection Series Biological Test Method EPS/1/RM/14) | 1 | Sterile Aquatox Pail |
| **Group 4** | MS-02 | MP-02<br>MP-03 | SP-02 | pH, TSS, TDS<br>N-NH3, TP<br>benzene, ehtylbenzene, toluene<br>O&G<br>total metals: As, Cu, Pb, Ni, Zn | 1 X 1L plastic or glass for on site lab analysis of pH and TSS<br>1 X 250ml glass bottle with H2SO4 preservative for NH3<br>3 X 40ml septa vials with no headspace for benzene, ethylbenzene and toluene<br>2 X 500ml glass with HCL preservatives for oil and grease<br>1 X 125ml HDPE with HNO3 preservative | 8 | On Site |
| **Group 5** | MS-03<br>MS-04<br>MS-05 (add TSS)<br>MS-MRY-6 | MP-03<br>MP-04 (add TSS) | SP-04<br>SP-05<br>SP-06 (add TSS) | pH, TSS<br>benzene, ethylbenzene, toluene<br>Total Lead (Pb)<br>O&G<br>total petroleum hydrocarbons (TPH) | 1 x 1L plastic or glass for on-site lab analysis of pH and TSS<br>3 X 40ml septa vials with no headspace and sodium bisulfate preservative for BTE, TPH (F1)<br>1 X 125ml HDPE with HNO3 preservative for total lead<br>2 X 500ml glass bottles with HCL preservative for Oil & Grease<br>2 X 500ml amber glass bottles with sodium bisulfate preservative for TPH (F2-F4) | 9 | On Site |
| **Group 6** | MS-MRY-13A<br>MS-MRY-13B | | SP-08 | pH, TSS, TDS<br>alkalinity, conductivity, DOC<br>O&G<br>phenols, TOC<br>total petroleum hydrocarbons (TPH - F1)<br>total petroleum hydrocarbons (TPH - F2-F4)<br>total full list of metals<br>total mercury | 1 X 1L plastic or glass for on site analysis of pH and TSS, turbidity, TDS<br>1 X 1L Plastic for alkalinity conductivity, DOC<br>2 X 500ml glass with HCL preservative for oil & grease<br>1 X 250ml glass with H2SO4 preservative for phenols(4AAP), TOC<br>3 X 40ml septa vials with no headspace and sodium bisulfate preservative for TPH (F1)<br>2 X 500ml amber glass bottles with sodium bisulfate preservative for TPH (F2-F4)<br>1 X 125ml HDPE with HNO3 preservative for total metals<br>1 X 120ml square glass with HCL preaservative for total mercury. | 12 | On Site |
| **Group 7** | MS-06+<br>MS-07<br>MS-09<br>MS-MRY-09<br>MS-MRY-10<br>MS-MRY-11<br>MS-08<br>MS-08-US<br>MS-MRY-10a | MP-07? | SP-07 | pH, TSS, TDS, turbidity<br>alkalinity, hardness, DOC, sulphate, fluoride, chloride<br>TKN, N-NH3, N-NO3, TOC, TP<br>Total Full List Metals<br>Dissolved Full List Metals<br>Total mecury<br>Dissolved mercury | 1 X 1L plastic or glass for on site analysis of pH and TSS, turbidity, TDS<br>1 X 1L Plastic for alkalinity, anions, DOC<br>1 X 250ml glass with H2SO4 preservative for tkn,nh3,toc, TP<br>1 X 125ml HDPE with HNO3 for total metals<br>1 X 125ml HDPE field filtered and preserved with HNO3 preservative for dissolved metals<br>1 X 120ml square glass with HCL for total mercury<br>1 X 120ml glass field filtered and preserved with HCL for dissolved mercury | 7 | On Site |
| **Group 7a** | MS-MRY-10a<br>MS-08-US<br>MS-08 | | | | | | |
| **Group 8** | MS-C<br>MQ-C | MP-C<br>MP-Q1 | | N-NH3<br>N-NO3, conductivity<br>pH, TSS<br>O&G | 1 X 1L plastic or glass for on site analysis of pH and TSS, turbidity<br>1 X 250ml glass with H2SO4 preservative for NH3<br>1 X 1L plastic or glass for NO3, conductivity<br>2 X 500ml glass with HCL preservative for oil & grease. | 5 | On SIte |

# APPENDIX F –

# OWS DISCHARGE LOG - EXTERNAL RESULTS SHEET



| Date | Time | Sample ID | Sample Location | External Analyses | | | | | | | | | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lead | Oil and Grease | Benzene | Toluene | Ethylbenzene | pH | TSS | Ammonia | Total Phosphorus | Arsenic | Copper | Nickel | Zinc | |
| Unit | hh:mm | | | µg/L | mg/L | µg/L | µg/L | µg/L | | mg/L | NH3-N mg/L | mg/L | mg/L | mg/L | | | |
| Limit | | | | 1 | 15 | 370 | 2.0 | 90.0 | | | | | | | | | |

Electronic file located on Mine Site Environmental Server:

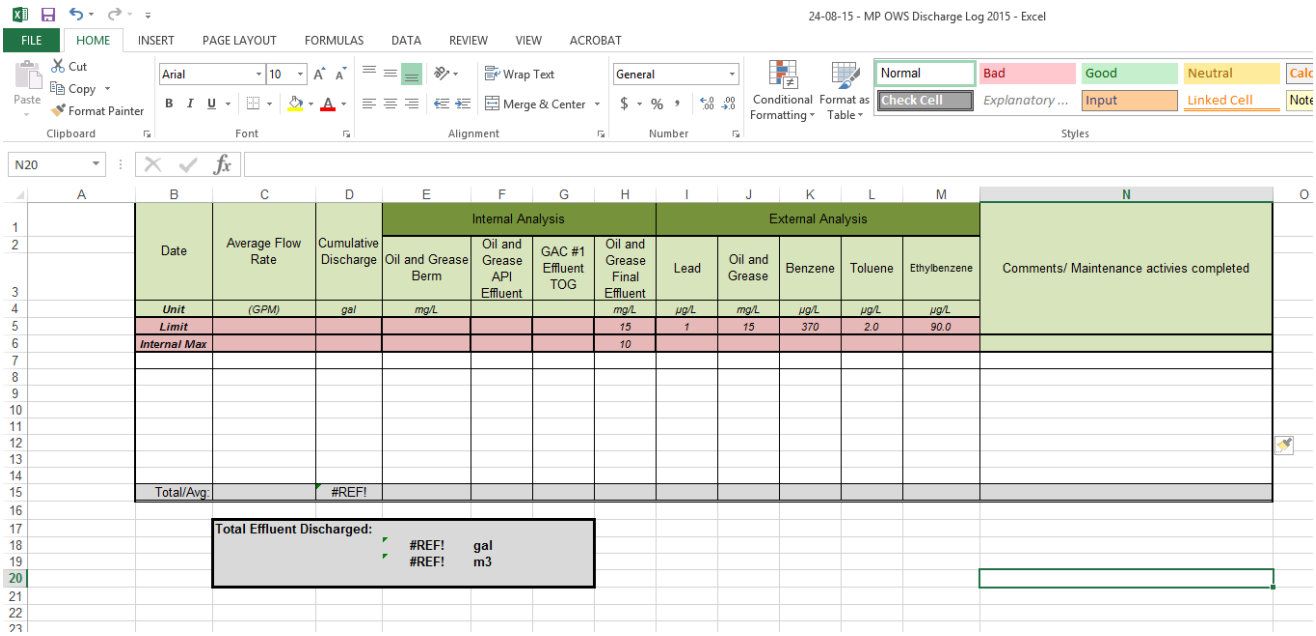
FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators


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# APPENDIX G –

# OWS DISCHARGE LOG – SUMMARY SHEET




Electronic file located on Mine Site Environmental Server:

FINAL File System\2.0 ENV MANAGEMENT, MONITORING PLANS (BIM INTERNAL)\2.08 Oily Water Separators


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# Appendix I – Oily Water Treatment Plant (For Vehicle Wash Water) O & M Manuals

(Available upon request)

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# Appendix J – BAF-PHl-340-PRO-048 – Waste Pond Water Treatment Plant Operations

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# Baffinland Iron Mines Corporation

## Waste Pond Water Treatment Plant Operations

## Rev 1.0


**Prepared By: Chet Fong**
**Department: Mine Operations**
**Title: Senior Mining Engineer**
**Date: 17/08/2018**
**Signature:**

**Approved By: Simon Fleury**
**Department: Mine Operations**
**Title: Mine Manager**
**Date: 17/08/2018**
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# 1 PURPOSE

This document outlines the basic procedure to safely operate the Water Treatment Plant

# 2 SCOPE

This document will cover the basic operations of the plant, including start up and shut down, monitoring, treatment, and emergency protocols and procedures for at risk activities at the Water Treatment Plant.

## 2.1 EXEMPTIONS

This document does not include instructions related to water treatment, which can be found in the plant Operations and Maintenance Manual.

# 3 RESPONSIBILITES

Any visitor shall request permission to the plant operator prior to entering the work area. In the absence of an operator, permission shall be requested to the mine supervisor.

The Plant operator shall ensure that everyone working in the plant wears the requisite PPE according to the activities being performed (e.g. chemical handling).

# 4 PROCEDURES

The information in this section is intended as a summary of plant operations. In the case of a discrepancy between this document and the Operations and Maintenance Manual, the latter will take precedence.

For full details on design and plant operation, refer to the operator's manual. In standard operations, the WTP is intended to draw water from the Waste Dump Pond and treat the intake water in 3 steps inside the WTP structure. The water is then discharged to a Geotube Settling Pond, where a fourth treatment step of settlement will occur, before water is either discharged into the environment or, if not compliant, recirculated back to the Waste Dump Pond.

The three steps of treatment involve the injection of chemical into temporary storage tanks.

- Step 1 – Iron Precipitation
- Step 2 – Hydroxide Precipitation and pH Adjustment

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- Step 3 – Flocculation
- Step 4 - Filtration

Steps 1-3 occur inside the WTP structure, with the 4th step taking place in the Geotube Settling Pond.

## 4.1 PLANT OPERATIONS

Plant operations consists primarily of managing flow, dosage and water levels across the pond, sump, and tanks. Flow is managed with a combination of control panel adjustments and manual valve manipulations.

The plant consists of the following components:

1. Intake Pump – pulls water from the Waste Dump Pond into the WTP
2. Onion tanks – water is stored for treatment prior to discharge. There are two trains, which can be run independently or concurrently.
3. Control panel – use to remotely manage pumps – can be set for automatic and manual operations
4. Dosing pumps – use to inject chemical into onion tanks at a fixed rate
5. Dosing tanks – mixing tanks from which chemicals (Lime, Polymer) is depleted at a configurable rate
6. Transfer pumps – used to take treated water from the plant out to the Geotube Pond
7. Geotube Pond – discharge from the plant is deposited here for particulate settlement prior to final discharge.
8. Discharge pump – used to pull treated water from the Geotube Pond to either be discharged into the environment or recirculated back to the Waste Dump Pond.
9. Blower motors – used to agitate water in onion tanks during treatment to ensure more even dispersion of chemicals.

Once the Plant is operational, the operator will commence with monitoring the measured levels of pH and suspended solids with built in instrumentations and gauges. These readings may be corroborated with manual instrumentations such as a YSI meter.

When readings indicate pH readings at the desired values, the operator shall then initiate discharging of water into the Geotube Pond. This water is allowed to percolate through the Geotube, which catches particulates as a filter. Once in the Sump, where any remaining particulates are then captured and settle into the bottom of the pond.

Water is discharged from this Geotube Pond, either directly into the environment or back into the Waste Dump Pond. The maximum flow rate for these discharging is 1200 gal/min, this limit imposed by the flowmeter installed.

At design capacity, the intake pump(s) should be able to pull water into the WTP for treatment at an equal rate to the discharge pump. The plant effectively runs continuously with dosing in-stream.

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## 4.2 Plant Start up

The following steps should be undertaken when starting up the WTP.

1. Ensure blower motors are activated.
2. Ensure all the Valves to the Geotube Sump are open.
3. Ensure the transfer pumps are switched to automatic
4. Check that all the intake valves are open
5. Keep valves open between tanks on each train
6. Start up intake pump and adjust pressure accordingly. To do this, adjust the following:
    a. Rpm of the pump
    b. Valve openings
7. Start Ferric Sulphate Dosing system. Ensure intake is in the Ferric Sulphate barrels, and there are no leaks present. Pumps should be activated.
8. Start Lime Dosing system. Dosing pumps should be activated.
9. Start up Polymer Dosing System. Dosing pumps should be activated

Plant operations can now commence.

## 4.3 Plant Shut Down

Plant shut down can be undertaken when it is to be unmanned for a longer period of time (eg. More than 2 shifts) within the same system (for winter decommissioning, procedure XXX). To run a plant shut down

1. Shut all intake valves
2. Shut all Ferric Sulphate dosing equipment
3. Shut all Lime dosing equipment
4. shut all Polymer dosing equipment
5. Rinse Lime lines (reference other procedure)

Plant can now be shut down. This procedure can be utilized with the onion tanks full. This should also be done before any interruptions in power due to generator maintenance or other causes.

## 4.4 Discharging

Discharging be undertaken whenever the plant is running. It is most efficient to run the discharge when there is moderate to high water levels in the Geotube Sump. The intake hose for the Geotube Sump should utilize the ring to ensure that drawn water is from the top of the water surface.

Discharging requires the manual operation of the valves to discharge the water either to the environment or back to the Waste Dump Pond. Readings should also be checked and logged on the flowmeter when discharge begins using the totalizer values.

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NOTE: discharge flow rate should be kept below 1200 gal/min, as flow greater than this will not be measureable.

To discharge, the following steps should be undertaken:

1. Ensure enough water to discharge. Water levels should be at least 50 centimetres from the bottom of the sump prior to beginning discharge.
2. Ensure valve on re-circulation line is closed. This will enable the water to discharge into the environment. Where re-circulation is required, close the valve on the discharge line and open the valve on the re-circulation line.
3. If discharging to the environment, check the totalizer reading on the flowmeter prior to discharge. This is not required if re-circulating.
4. On the control panel, Set discharge to "on"
5. While discharging, check discharge pH and Turbidity with sampling tap periodically. Samples can be collected and tested using YSI instrument.
6. When discharging is complete or to be disabled, go to control panel and set discharge to "off"

## 4.5 CHEMICAL DOSING

Chemical dosing is performed as part of the treatment process. The primary drivers for chemical dosing is:

1. Reduce the pH
2. Reduce the suspended solids

Prior to discharging water back into the environment.

As dosing quantities will vary depending on flow rate and water qualities, refer to user manual for dosing quantities.

Dosing procedures will vary slightly between the stages of treatment. The three stages that require chemical intervention are Ferric Sulphate, Lime, and Polymer.

### 4.5.1 FERRIC SULPHATE – LIQUID

PPE Required: long chemical resistant gloves, apron, face shield, standard PPE

- Prepare a barrel for dosing by placing the barrel into the duck pond by the ferric sulphate dosing area and removing the top seal.
- Put 2 dosing pumps into 1 barrel (1 per train)
- Switch on dosing pump on the control panel
- On the pump, check frequency and stroke length to ensure dosage is as expected.
- To change barrels, switch off on the dosing pump and change barrel

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#### 4.5.2 LIME – BAGS

PPE Required: long chemical resistant gloves, respirator, face shield, respirator, standard PPE

- Fill mixing tank with intake water.
- Check filter on accessory intake water line (dedicated line for filling lime and polymer mixing tanks)
- Open valve on AI water line (fill tank). Fill to required water levels
- Ensure mixer is operating
- Add lime to water

#### 4.5.3 POLYMER – BAGS

PPE Required: standard PPE

- Fill mixing tank with intake water.
- Check filter on accessory intake water line (dedicated line for filling lime and polymer mixing tanks)
- Open valve on AI water line (fill tank). Fill to required water levels
- Ensure mixer is operating
- Add polymer to water

### 4.6 SYSTEM AUTOMATION

For instruction on System Automation, please refer to the Operations and Maintenance Manual.

### 4.7 TROUBLE SHOOTING

For issue identification, please refer to the checklists in the Operations and Maintenance Manual.

### 4.8 ACCIDENT RESPONSE

As the WTP involves the handling of a number of chemicals that may be harmful, precautions must be taken to ensure all personnel who are in the work area are informed of the hazards and the preventative and treatment measures.

#### 4.8.1 RESPONSE EQUIPMENT AVAILABLE

The WTP is equipped with a stationary emergency shower, 2 portable emergency shower stations and eyewash stations (dual purpose), 2 fire extinguishers, and 1 stationary eyewash station.

Additionally, the WTP is equipped with spare PPE, face shields, respirators, chemical resistant gloves, hearing protection, and spill kits.

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There are also patch kits for the onion tanks, hose and fitting replacements, tools, and a base station radio available at the WTP.

In the event that an incident occurs that requires emergency response, same basic steps should be immediately undertaken. The following lists some of the possible situations and a brief of the response steps.

### 4.8.2 Spills on the ground

- Retrieve spill pad kit
- use gloves to handle
- dispose in drum
- Label and dispose.

### 4.8.3 Spills on person

- Proceed to stationary emergency shower
- Notify secondary operator
- Secondary operator activates pump switch
- Pull handle and rinse for 10 mins
- If unable to proceed to stationary emergency shower, refer to “emergency response procedure”

### 4.8.4 Lime in eyes

- If possible, proceed immediately to emergency eyewash station
- Activate emergency eyewash and rinse for 10 mins.
- Repeat if required
- Notify secondary operator
- If unable to proceed to emergency eyewash station, refer to “emergency response procedure”

### 4.8.5 Lime spill

- Retrieve spill pad kit
- use gloves to handle
- dispose in drum
- Label and dispose.

## 4.9 APPENDICIES

*Appendix A – Operations and Maintenance Manual for Mary River Mine Waste Rock Pile Water Treatment Plant*

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# APPENDIX A – OPERATIONS & MAINTENANCE MANUAL FOR MARY RIVER MINE WASTE ROCK PILE WATER TREATMENT PLANT
# 20180817_v02

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# OPERATIONS & MAINTENANCE MANUAL FOR MARY RIVER MINE WASTE ROCK PILE WATER TREATMENT PLANT 20180817_v02

**Baffinland Iron Mines Corporation**

**Prepared by:**

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Project No. 137-0001

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# 1.0 INTRODUCTION

This documents outlines the Operations Manual for Baffinland Iron Mine Corporation's (BIM) Mary River Mine Waste Rock Pile water treatment plant (WTP).

# 2.0 PLANT OVERVIEW

## 2.1 General Process Description

The WTP employs a process of coagulation, pH adjustment, flocculation, and filtration to treat acid rock surface runoff collected in the pond at the base of the waste rock pile. The objective of the system operation is to treat water to within the parameters outlined in the Metal Mining Effluent Regulations (MMER), as specified to McCue by BIM, and summarized in Table 1.

**Table 1: MMER Effluent Limits**

| Parameter | Unit | Maximum Authorized Monthly Mean Concentration | Maximum Authorized Concentrations in a Composite Sample | Maximum Authorized Concentration in a Grab Sample |
|---|---|---|---|---|
| Arsenic | mg/L | 0.5 | 0.75 | 1.00 |
| Copper | mg/L | 0.3 | 0.45 | 0.60 |
| Cyanide | NTU | 1.00 | 1.50 | 2.00 |
| Lead | mg/L | 0.20 | 0.30 | 0.40 |
| Nickel | mg/L | 0.50 | 0.75 | 1.00 |
| Zinc | mg/L | 0.50 | 0.75 | 1.00 |
| Total Suspended Solids | mg/L | 15.00 | 22.50 | 30.00 |
| Radium 226 | Bq/L | 0.37 | 0.74 | 1.11 |
| pH | SU | 6-9.5 | 6-9.5 | 6-9.5 |

The treatment steps are described in Section 2.2. Refer to drawings in Appendix A:

## 2.2 Brief Process Overview

### 2.2.1 *System Inlet*

Water is collected at an inlet storage pond (P-001) where it is held for treatment. Two diesel powered centrifugal trash pumps (PU-100A/B) are used to transfer water from the storage pond to an equipment enclosure where the WTP is housed.

At the WTP, the flow can be divided into two separate treatment trains (1 and 2), with each train having a flow meter on the inlet line to monitor flow.

Water is directed into two reactor tanks (TA-110 and TA-210) for processing.

### 2.2.2 *Step 1 – Iron Precipitation*

Ferric sulphate solution is injected into TA-110 and TA-210 to promote coagulation and precipitation of some heavy metals.

As of system commissioning in June 2018, ferric sulphate liquid solution (12% Fe) is used and injected directly into the process. Each process train utilizes an independent chemical pump to introduce chemical into the system.

The WTS also includes a ferric sulphate make down system, including a holding tank and mixer to allow for makeup of solution using dry ferric sulphate.

Each reactor tank includes a pH sensor to provide continuous monitoring of pH.

Each reactor tank is equipped with four air diffusers which supply air to the process and provide continuous mixing so that solids are kept suspended. Each train is supplied air by a dedicated blower.

### 2.2.3 *Step 2 – Hydroxide Precipitation and pH Adjustment*

Water flows by gravity from TA-110 and TA-210 to TA-120 and TA-220 respectively. Here, hydrated lime is injected into the process to increase pH and aid in further precipitation of some metals through hydroxide precipitation.

Hydrated lime solution is made manually by adding dry hydrated lime and raw influent water to a mixing tank (TA-020). A mixer is run continuously to ensure the hydrated lime slurry does not solidify.

One hydrated lime chemical pump is utilized to dose each reactor tank with chemical. Two motorized valves (MV-120 and MV-220) are used to control the flow of lime to each reactor tank. Each reactor tank includes a pH sensor to provide continuous monitoring of pH.

Each reactor tank is equipped with four air diffusers which supply air to the process and provide continuous mixing so that solids are kept suspended. Each train is supplied air by a dedicated blower.

### 2.2.4 *Step 3 – Flocculation*

Water flows by gravity from TA-120 and TA-220 to TA-130 and TA-230 respectively. Here, polymer is injected into the process to aid in flocculation of suspended solids prior to filtration.
Polymer solution is made manually by adding dry polymer and raw influent water to a mixing tank (TA-030). A mixer is run continuously to ensure uniformity of the polymer solution.

Two polymer chemical pumps are utilized to provide polymer dosing to each train. Polymer can be dosed directly into each reactor tank, or inline through a static mixer located directly downstream of the reactor tank.

### 2.2.5 *Step 4 – Filtration*

Water from TA-130 and TA-230 is pumped to a geotube pond via two diesel powered centrifugal trash pumps (PU-200A/B).

Water is directed to a manifold where it can be distributed to two geotube bags for solids filtration. Two additional geotube bags can be deployed in the pond once the currently operating geotube bags have reached capacity. These spare geotubes are currently stored in a warehouse for future use.

Filtered water leaves the geotube bags and is directed to a collection point at the North West corner of the pond. From here, water is pumped via one diesel trash pump (PU-300) to the Mary River discharge point, or recycled back to the inlet pond. A flow meter is installed on the discharge line to Mary River to allow for data logging of flow.

## 2.3 Major Equipment List

The WTP layout is provided in appendix A. A list of major equipment is provided in Table 2.

**Table 2: Major WTP Equipment**

| Equipment | Description | Qty | Drawing Reference (If Available) |
|---|---|---|---|
| Pond Transfer Pump | Model: Prime Aire PA4A60-404ST<br>Power: Diesel Driven<br>Capacity: 140m3/hr | 2 | PU-100 A / PU-100 B |
| Inlet Flow Meter | Model: GF Signet 3-2551-P1-42 | 2 | FT-100 / FT-200 |
| Ferric Reaction Tank | Material: Polyurethane<br>Size: 5.9m W x 1.5 H<br>Capacity: 24,820 Liters | 2 | TA-110 / TA-210 |
| Lime Reaction Tank | Material: Polyurethane<br>Size: 5.9m W x 1.5 H<br>Capacity: 24,820 Liters | 2 | TA-120 / TA-220 |
| Polymer Reaction Tank | Material: Polyurethane<br>Size: 5.9m W x 1.5 H<br>Capacity: 24,820 Liters | 2 | TA-130 / TA-230 |
| Aeration Blowers | Gast R7100A-3 Blower<br>• 208 V / 3 HP / 60 Hz | 2 | BL-100A / BL-100B |
| pH Controller and Sensors | Model: Walchem W900 (Controller)<br>Model: Walchem WEL-PHF-NN (Sensors) | 1 | pH-110/120/210/220 |
| Motorized Ball Valve | Hayward 1” Ball Valve<br>Model: HRSN2 | 2 | MV-120 and MV-220 |
| Level Transmitter | Model: Echosonic 11 LU27 | 2 | LT-130 / LT-230 |
| Bag Filter | Model: FTI830-2P-150-CS-BS-P13-DP<br>Bag Size: 5 Micron | 1 | FIL-100 |
| Ferric Chemical Pump | Model: Walchem EHE31E1-VC<br>Power: 115 VAC/1hp/60Hz<br>Capacity: 1 LPM @ 105m TDH | 2 | PU-010A / PU-010B |
| Lime Chemical Pump | Model: Flowmotion FR25-HR30HR<br>Power: 230V/3hp/60Hz<br>Capacity: 9.5 LPM @ 105 m TDH | 1 | PU-020 |
| Polymer Chemical Pump | Model: Flowmotion FR25-HR30HR<br>Power: 230V/3hp/60Hz<br>Capacity: 16.5 LPM @ 105 m TDH | 2 | PU-030A / PU-030B |
| Ferric Mixing Tank | Material: Polyurethane<br>Size: Ø 1.2m x 1.3m Height | 1 | TA-010 |
| Lime Mixing Tank | Material: Polyurethane<br>Size: Ø 1.8m x 1.7m Height | 1 | TA-020 |
| Polymer Mixing Tank | Material: Polyurethane<br>Size: Ø 1.6m x 1.6m Height | 1 | TA-030 |
| Coarse Bubble Diffusers | Model: Maxair 24” SS | 24 | - |

## 2.4 System Automation

The system is automated through a main control panel located in the system enclosure. The system P&ID is provided in Appendix A. Operation is outlined in Table 3.

**Table 3: Control Panel Automation**

| Equipment ID | Equipment Description | Control Logic | PID Control Reference | Controls | Panel Indication |
|---|---|---|---|---|---|
| PU – 100 A/B | Inlet Pond Pump | Units can be controlled in Hand or in Auto.<br><br>Pump will turn on in Hand in Auto or in Hand. | - | - | Pump icon will indicate run status |
| | | Pump will turn off if high level is measured in TA-110 or TA-210 | LSH-110 / LSH-210 | Auto | High level alarm at panel |
| | | Pump will turn off if high level measured in TA-130 or TA-230 | LIT-130 / LIT-230 | Auto - High level settable at panel | High level alarm at panel |
| BL-100 A/B | Blower | Units can be controlled in Hand or in Auto<br><br>Blower will turn on in Auto or in Hand | - | - | Blower icon will indicate run status |
| | | BL-100 A will turn off if low level is measured by LIT-130 | LIT-130 | Auto – Low level settable at panel | Low level alarm |
| | | BL-100 B will turn off if low level is measured by LIT-230 | LIT-230 | Auto – Low level settable at panel | Low level alarm |
| pH-110 | pH Sensor | Continuous monitoring of pH | - | - | Display pH on PLC |
| pH-210 | pH Sensor | Continuous monitoring of pH | - | - | Display pH on PLC |

| | | | | | |
|---|---|---|---|---|---|
| pH-210 | pH Sensor | If pH>9.5, close MV-120 - Alarm | MV-120 | Auto – pH set point settable at panel | Display pH on PLC |
| pH-220 | pH Dosage | If pH>9, close MV-220 - Alarm | MV-220 | Auto – pH set point settable at panel | Display pH on PLC |
| PU-010A | Ferric Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If FIT-100 measures flow, PU-010A energizes. | FIT-100 | Auto | Display run status on PLC |
| PU-010B | Ferric Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If FIT-200 measures flow, PU-010B energizes. | FIT-100 | Auto | Display run status on PLC |
| PU-020 | Lime Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | **Speed Control (1 train only)** If pH-120> 8.5, PU-020 will reduce speed. If pH < 8, pump will increase pump speed. If pH is between 8 to 8.5, pump will maintain pump speed. | pH-110 / pH-120 | Auto – pH set point adjustable at panel | Display run status on PLC |
| | | **Speed Control Disabled** If flow is detected by both trains, speed control is disabled. | FIT-100 / FIT-200 | Auto | Display run status on PLC |
| PU-030 A | Polymer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |

| | | | | | |
|---|---|---|---|---|---|
| | | Polymer pump energizes if PU-200 A is on | PU-200A | - | Display run status on PLC |
| PU-030 B | Polymer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | Polymer pump energizes if PU-200 B is on | PU-200B | - | Display run status on PLC |
| PU-200 A | Transfer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If LT-130 measures < 3', PU-200A off. If LT-130 measures >3', PU-200A on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| | | If LT-130 measures >4.5', PU-200A off. If LT-130<4.5', PU-200A on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| PU-200 B | Transfer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If LT-230 measures < 3', PU-200B off. If LT-230 measures >3', PU-200B on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| | | If LT-230 measures >4.5', PU-200B off. If LT-230<4.5', PU-200B on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| PU-300 | Discharge Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | Pump off at LSL-200 | LSL-200 | - | Level indicator on panel |

| | | | | | |
|---|---|---|---|---|---|
| | | Pump on at LSH-200 | LSH-200 | - | Level indicator on panel |
| | | High Level Alarm at LSHH-200 | LSHH-200 | - | High Level Alarm |
| MX-010 /020/030 | Mixer | Units can be controlled on/off manually | - | - | - |

# 3.0 GENERAL STARTUP PROCEDURE

## 3.1 After Dormancy Pre-start-up Procedures

The following steps shall be taken after extended periods of dormancy, prior to general startup of the WTP.

| Task | Check |
|---|---|
| Perform a visual inspection of the system enclosure for signs of water/snow ingress. | ☐ |
| Inspect hose and pipe for signs of leaks, abrasion, or other physical damage. | ☐ |
| Inspect Reactor tanks as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Tank connections for signs of strain or stress.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Blowers as follows:<br>• Signs of abrasion, or other physical damage on all external accessories such as relief valves, gauges and filters.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Diesel Pumps as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Check for and tighten loose attaching hardware.<br>• Make sure that valves at the inlet and outlet are opened.<br>• Check oil levels and lubricate as necessary. | ☐ |
| Inspect Ferric Sulphate pump as follows<br>• Signs of leaks, abrasion, or other physical damage.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Hydrated Lime pumps as follows<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect condition of internal pump hose.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Polymer pump as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect condition of internal pump hose.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Level Transmitter as follows:<br>• Monitor debris and ensure the sensor is level and mounted perpendicular to water level.<br>• Check and roughly compare measurement on the PLC with the real on the field. | ☐ |
| Inspect pH sensors as follows:<br>• Monitor debris and deposition of scaling on the transmitter. Perform a cleaning of the sensors as necessary. | ☐ |

-

| | |
|---|---|
| Insect Bag Filter vessel as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect filter bag and replace as necessary | ☐ |
| Inspect Inlet Flow Meter as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect flow sensor for scaling. Clean as necessary. | ☐ |
| Inspect Geotube Bag as follows:<br>• Ensure inlet connection points are securely attached.<br>• Ensure height of bag does not exceed recommended limits. If so, decommission geotube bag.<br>• Clean geotube surface of sediment and scaling to prevent fouling using a push broom, or gentle pressure washing. | ☐ |

## 3.2 Commissioning

After pre-start-up procedures are completed, the system can be energized. The following procedure reflects a high level overview of equipment checks to be performed. Detailed instructions can be found in the product specific manuals. Before any mechanical intervention, disconnect the electrical supply.

### 3.2.1 *Hydrated Lime Pump / Polymer Pump*

| Task | Check |
|---|---|
| Ensure that all protections (cover, cover window, ventilator hood, coupling protection) are in place before operating the pump. | ☐ |
| Check the direction of rotation of the pump. | ☐ |
| Make sure that valves at the inlet and outlet are opened. | ☐ |
| Start the pump by checking its direction of rotation through the cover window. | ☐ |
| Check the flow and discharge pressure and adjust rollers if these figures don't match the pump specifications. | ☐ |

**IMPORTANT:** Ensure lime pump valves remains open during operation. Should valves be left in the closed position, the process line can over pressurize, leading to a rupture of the chemical hose.

### 3.2.2 *Blowers*

| Task | Check |
|---|---|
| Ensure impeller rotation is correct. | ☐ |
| Check filters and inspect for signs of fouling. Replace if necessary. | ☐ |

-

| | |
|---|---|
| Ambient temperature – Check room and discharge air temperatures. Exhaust air should not exceed 135ºC. | ☐ |
| Working pressure and vacuum values – Adjust relief valve pressure or vacuum setting, if needed. | ☐ |
| Motor current – Check that the supply current matches recommended current rating on product nameplate. | ☐ |
| Electrical overload cutout – Check that the current matches the rating on product nameplate. | ☐ |

### 3.2.3 *Ferric Pump*

| Task | Check |
|---|---|
| Ensure pump is energized. | ☐ |
| Make sure that valves at the inlet and outlet are opened. | ☐ |
| Start the pump manually, in order to prime and adjust dosing rates. | ☐ |
| Prime the pump. See manual for details. | ☐ |
| Adjust dosing according to inlet water flow rate. See below. | ☐ |
| Check dosing rate with calibration cylinder. | ☐ |

### 3.2.4 *Motorized Valve*

| Task | Check |
|---|---|
| Ensure valve is energized. | ☐ |
| Ensure valve opens/closes reliably in manual mode: | ☐ |

### 3.2.5 *Diesel Pumps*

| Task | Check |
|---|---|
| Check fuel level and oil levels in the engine, air compressor, pump bearings and seal housing. | ☐ |
| Consult engine operations manual before attempting to start the unit. | ☐ |
| Allow pump to prime. | ☐ |
| Adjust engine speed to desired output. | ☐ |

### 3.2.6 *pH Sensors*

| Task | Check |
|---|---|
| Ensure sensor is calibrated. | ☐ |
| Ensure the pH reading displayed locally at the Walchem panel is transmitted correctly to PLC. | ☐ |

### 3.2.7 *Geotube*

| Task | Check |
|---|---|
| Ensure surface is clean of sediment and debris. | ☐ |
| Ensure all inlet valve are open. | ☐ |
| Ensure height of geotube does not exceed manufacturer recommended limit. | ☐ |

# 4.0 OPERATION

## 4.1 General Operating Instructions

Operation of the WTP will consist of ensuring major equipment (blowers, dosing pumps, motorized valves, level transmitters) is running correctly, and ensuring influent/effluent monitoring and sampling are conducted on schedule.

The drivers for pH adjustment and TSS treatment are operation of the Ferric Sulfate, Hydrated Lime and Polymer Pump, along with the proper performance of the aeration blowers and diffusers equipment.

The unit will run manually. During short term dormancy, the unit can be operated in a “Sleep Mode” where the system is run in a re-cycle status using two submersible pumps inside TA-130 and TA-230 to recirculate water from the end of each train to the beginning of each train. Chemical injection is disabled during dormancy, however, the lime mixer should remain on to maintain suspension of the hydrated lime slurry. Blowers will also remain on to ensure suspension of solids within the reactor tanks.

Parameters to be measured and recorded daily include temperature, pH (typical values are between 6.5 and 9), and TSS. The system must be monitored regularly to ensure pH does not drop below the low level set point or raise above the level set point.

The pH reading should be recorded daily. The pH should be cross referenced regularly with a hand held device. Should the pH differ from the hand held reading, the operator should clean the pH electrodes using a 2-5% solution of hydrochloric acid.

System data can be recorded in the spreadsheet provided in Appendix B. Regular daily monitoring of parameters such as pH, temperature, TSS, and Geotube height must be recorded to ensure proper operation.

## 4.2 Operating Procedure

The following section will outline the step-by-step procedures for operating the treatment system.

### 4.2.1 *Standard Operation*

**Inlet**

The inlet pond level should be checked and recorded prior to start up. Two pond pumps can be utilized to transfer raw water to the treatment system. Usage will depend on the volume of treatment required. At low pond levels, one pond pump and one process train can be utilized. At high levels, both pumps can be utilized to increase the treatment volume.

All pump discharge valves must be opened. The pumps (PU-100 A/B) shall be placed in “Hand” at the PLC. This will energize the pumps and begin transfer of water to the treatment system. The pumps will only turn on if a high level is measured by LSH-110/210 or LT-130/230.

Operators must ensure the inlet pond level is monitored, as the pumps do not include a low level shut off.

**Ferric Pumps (PU-010 A/B)**

Water is transferred from the inlet pond to two reactor tanks (TA-110 and TA-210) where ferric sulphate is injected. The dosage rate of the ferric pumps is determined by the inlet quality of the raw water and can range from 0 to 20 mg/l. The dosage rate is to be determined by the operator.

The dosage rate must be set manually at the pump. Once set, the pump can be set to “Auto” at the control panel. The ferric pumps, PU-010 A and PU-010 B, will energize when flow is detected by FIT-100 and FIT-200 respectively.

Before starting the pumps, all discharge valves must be opened.

**Lime Pump (PU-020)**

After coagulant addition, water flows by gravity to TA-120 and TA-220 where hydrated lime is injected into the process. The dosage rate of the Lime pump is determined by the inlet quality of raw water and the pH required, and can range from 0 to 300 mg/l. The dosage rate is to be determined by the operator.

In manual mode, the speed of the pump can be set at the pump VFD, located on the lime pump stand.

Pump speed will be dependent on the pH measured by pH-120, and the pH set point entered into the panel (adjustable by an operator). At a setpoint of 8.5, the pump will increase speed if pH-120 measures a pH below 8. If pH-120 measures a pH above 9, pump speed will decrease. If pH is measured between 8 to 8.5, the dosage rate will remain the same.

-

At a pH above 9.5, MV-120 and MV-220 will close.

The lime pump will operate continuously, with chemical consistently recirculated to the lime mixing tank (TA-020). This is done to ensure the lime slurry does not settle and solidify in the piping system. At the end of every shift, clean water must be flushed through the piping in order to prevent fouling. Flushing may be required more frequently depending on operational conditions.

Due to the possibility of fouling, the lime pump system must be monitored for pressure consistently.

**Lime Solution Make Up**

Hydrated lime solution is made manually, with the solution concentration ranging from 5-10% depending on volume of raw water to be treated. A concentration of 5% is recommended to minimize line fouling caused by the lime slurry. Higher concentrations can be made, but more frequent line flushing will be required.

The lime tank mixer is operated from the panel, and should be operated continuously to prevent the slurry from solidifying.

**Polymer Pumps (PU-030 A/B)**

The dosage rate of the ferric pumps is determined by the inlet quality and can range from 0 to 3 mg/l.

The dosage rate must be set manually at the pump. Once set, the pump can be set to “Auto” at the control panel. The polymer pumps, PU-020 A and PU-020 B, will energize when the transfer pumps, PU-200 A and PU-200 B are energized.

Before starting the pumps, all discharge valves must be opened.

**Polymer Solution Make Up**

Polymer solution is made manually, with concentration ranging from 0.1 to 0.25% depending on volume to be treated.

The polymer tank mixer is operated from the panel, and should be kept on at all times to maintain uniformity of the solution.

**Blowers**

The blowers are operated from the panel, and should be energized at all times when raw water is being processed in the reactor tanks.

Both blowers (BL-100A and BL-100B) can be set in “Auto” at the panel, at which point they will run continuously until the water level in TA-130 and TA-230 is measured to be less than 6”. This level is settable at the panel.

**Raw Water Bag Filter**

The bag filter provides filtration of water required for chemical makeup. The filter bags should be replaced periodically when differential pressure across the filter exceeds approximately 20 psi.

**Geotube Bags**

Water is transferred from the final reactor tanks (TA-130 and TA-230) by diesel generated trash pumps (PU-200 A and PU-200 B) to the geotube pond. The transfer pumps, PU-200A and PU-200B are operated based on the level measured by the reactor tank level transmitters, LT-130 and LT-230 respectively. These set points are adjustable at the panel.

The height of the geotube bags must be monitored regularly.

## 4.3 Daily Operator Checklist

The following steps outline day-to-day operational procedures for the WTS.

Standard Operation

| Task | Check |
|---|---|
| Check inlet pond and record water level | ☐ |
| Check lime and polymer solutions, make up additional solution as required. | ☐ |
| Place PU-100 A (and PU-100 B if necessary) in Hand mode at the control panel. | ☐ |
| Set Ferric Sulphate pump (PU-010 A / B) dose rate and place pump in Auto at control panel. Ensure pump energizes when flow is detected by FIT-100 or FIT-200. | ☐ |
| Turn on hydrated lime pump (PU-020 A) manually. Adjust dose rate based on flow measured by inlet flow meters. | ☐ |
| Monitor hydrated lime pump pressure gauge. If pressure gauge is showing a pressure greater than 15 psi, flush line with water. | ☐ |
| Set polymer pump dose rate at panel. Set in “remote” mode. Set pump to auto at panel. Pump will turn on when PU-200A/B energize. | ☐ |
| Set Blowers (BL-100 A / BL-100B) to Hand. | ☐ |
| Once onion tanks are full, set PU-200A/B to Auto (if using both trains). Ensure downstream valves to geotube bags are open. | ☐ |

| | |
|---|---|
| Observe reactor tank water levels to ensure inlet and outlet flows are balanced. | ☐ |
| Observe and record height of geotube bags. Height must not exceed 6 feet. | ☐ |
| Set PU-300 to auto in the panel. Once the water in the pond reaches the operating float switch, the pump will be energized. | ☐ |
| Discharge vales must be set manually to allow for discharge to the creek, or recycle back to the inlet pond. Set valves in correct position. | ☐ |

**Daily Shutdown**

| **Task** | **Check** |
|---|---|
| Set inlet pump to Off position | |
| Allow reactor tanks to be pumped down to ¼ volume. | ☐ |
| Turn off chemical pumps. | ☐ |
| Flush lime line with water | ☐ |
| Keep lime mixer (Mix-020) on to ensure hydrated lime slurry remains in liquid form. | ☐ |
| If tanks are lowered, blowers can be turned off. If tanks are kept full, energize recirculation pumps. | ☐ |
| Check lime and polymer solutions, make up additional solution if required. | ☐ |
| Turn transfer pumps (PU-200 A/B) and discharge diesel pump (PU-300) off. | ☐ |

# APPENDIX A –DRAWINGS




NOTES:

PU-200A/B- Transfer Pump
PU-300- Discharge Pump
FT-300- Flow Meter
LS- Level Switch
-LSHH 200
-LSH 200
-LSL 200

Process lines
Instrumentation lines

Process based on conceptual desgin by Golder Associates

REVISION TABLE

| No. | DESCRIPTION | DATE |
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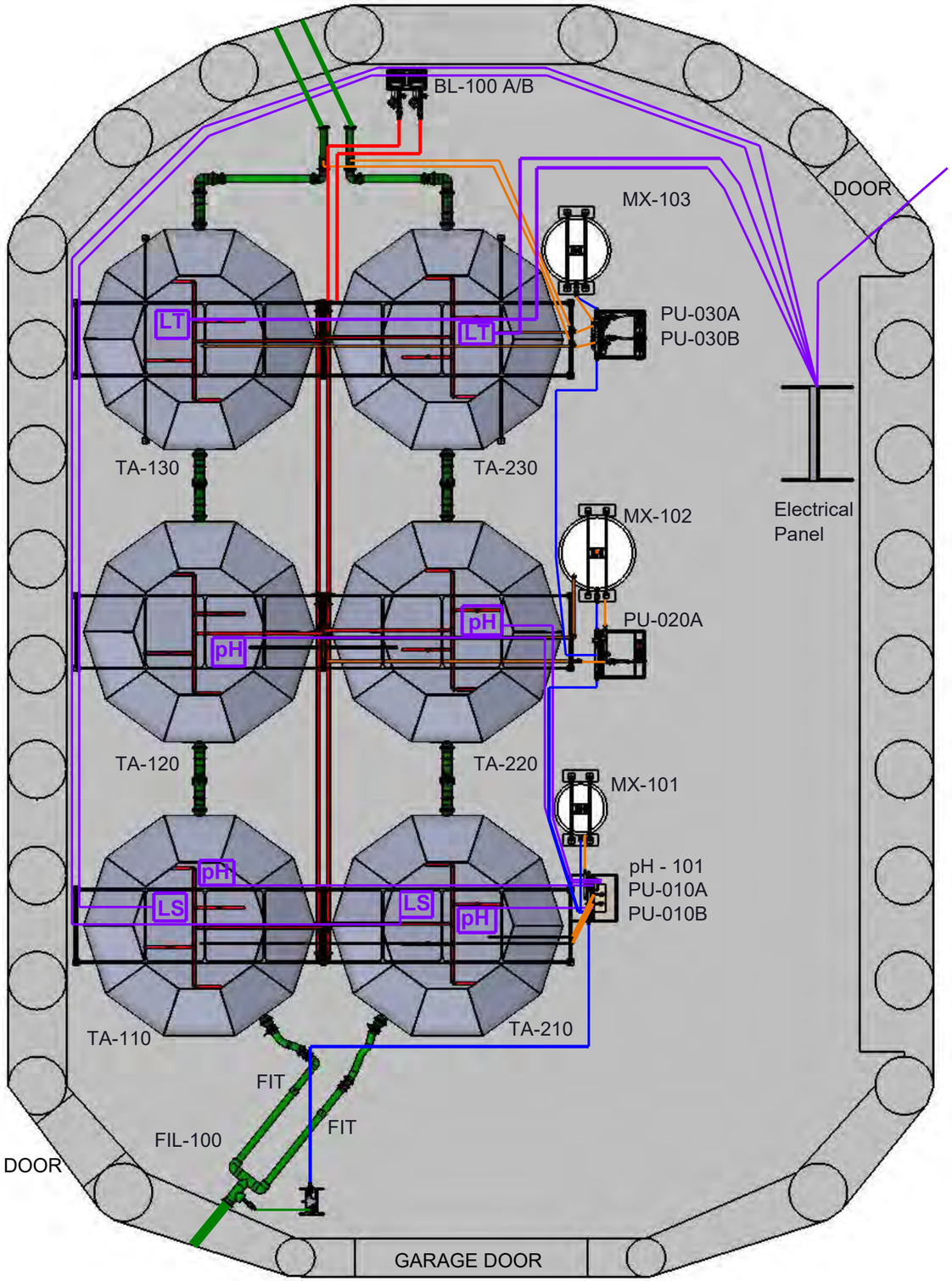
McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

**FULL SITE LAYOUT**
**GENERAL ARRANGEMENT DRAWING**
**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: L.S | FIG: GA-001 |




**LEGEND**

BL-100 A/B - Blower
FIL-100 - Bag Filter
MX-101 - Ferric Mixing Station
MX-102 - Lime Mixing Station
MX-103 - Polymer Mixing Station
PU-010 A/B - Ferric Pump
PU-020 - Lime Pump
PU-030 A/B - Polymer Pump
TA-110 - Ferric Process Tank (Train 1)
TA-210 - Ferric Process Tank (Train 2)
TA-120 - Lime Process Tank (Train 1)
TA-220 - Lime Process Tank (Train 2)
TA-130 - Polymer Process Tank (Train 1)
TA-230 - Polymer Process Tank (Train 2)
pH-101 - pH Controller
FIT - Flow Meter
pH - pH Sensor
LS - Level Switch
LT - Level Transmiter

**Notes:**

- Process Lines
- Water Make-up Lines
- Chemical Lines
- Air Lines
- Instrumentation Line

**Process based on conceptual design by Golder Associates**

REVISION TABLE

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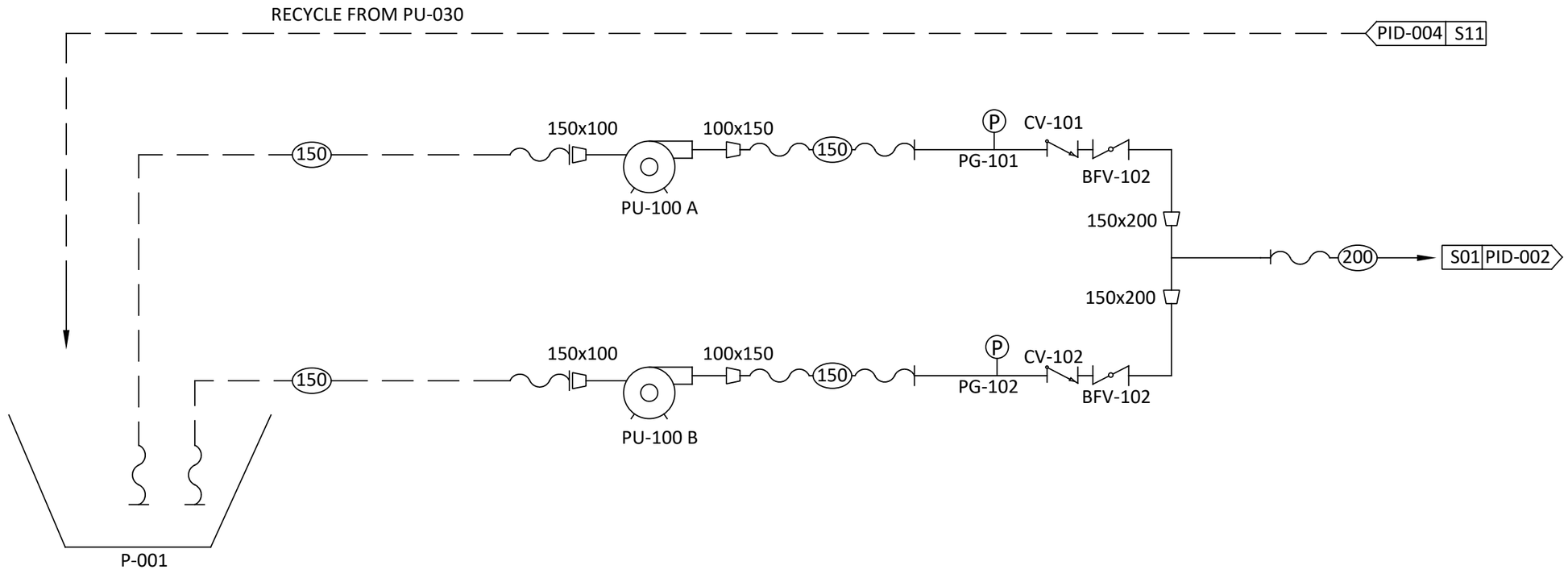
McCUE ENGINEERING CONTRATORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

**BUILDING LAYOUT**
**GENERAL ARRANGEMENT DRAWING**
Waste Rock Pile Water Treatment Plant

| | |
|---|---|
| DATE: August 17, 2018 | SCALE: AS SHOWN |
| DATA BY: R.B | JOB NO: 137-0001 |
| DRAWN BY: L.S | FIG: GA-002 |




P-001
Inlet Storage Pond

PU-100 A/B
Pond Transfer Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 140m³/hr

**LEGEND :**

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
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| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
| | | |

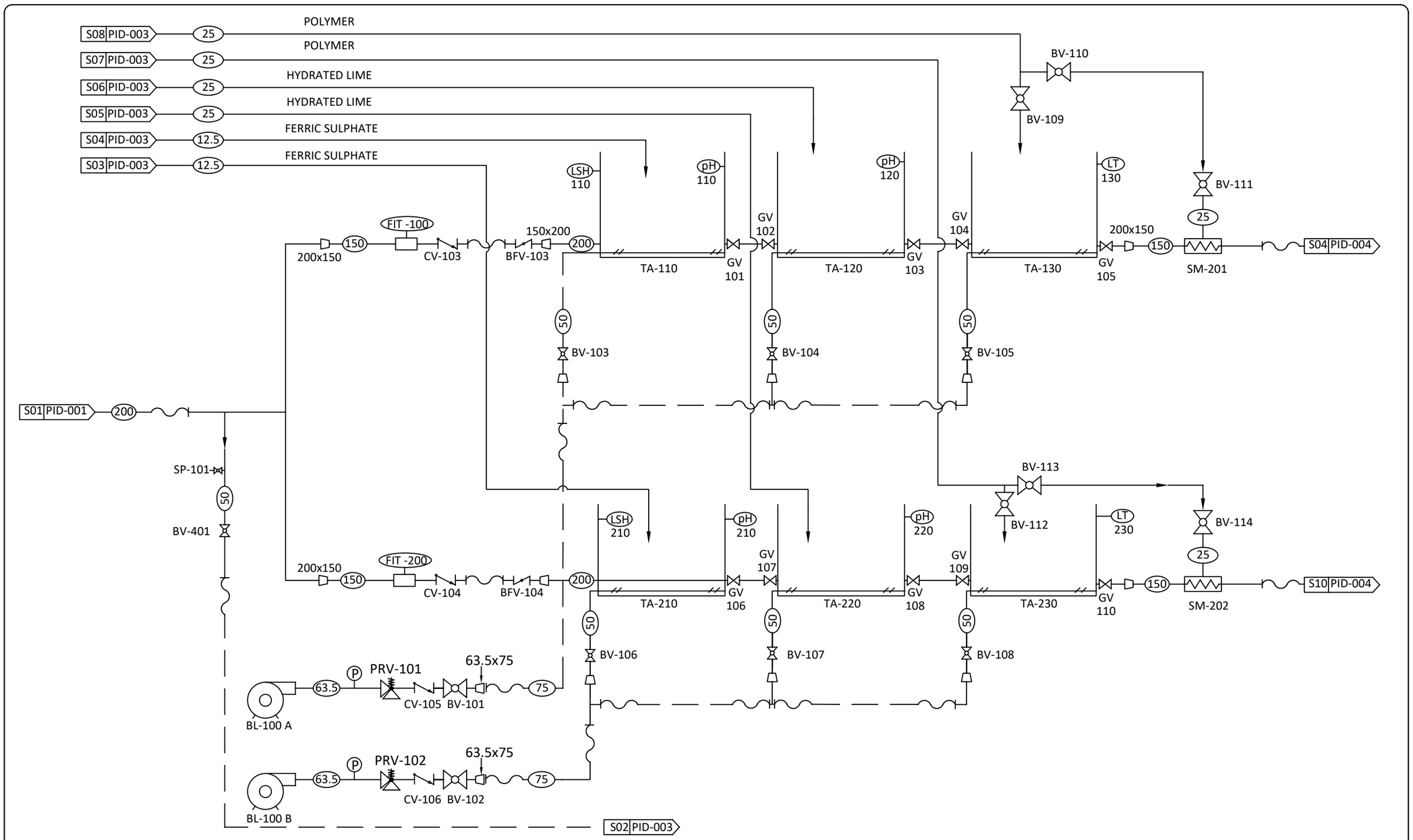
McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

**Waste Rock Water Storage Pond**
**PROCESS & INSTRUMENTATION DIAGRAM**
**Waste Rock Pile Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-0001 |




**BL-100 A/B**
Blower
Model: Gast R7100A-3
Power: 208V/3hp/60Hz
Capacity: 500m³/hr @ 1.9m TDH

**TA-110/210**
Ferric Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

**TA-120/220**
Lime Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

**TA-130/230**
Polymer Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

**FT-100/200**
Influent Flow Meter
Model: GF Signet 3-2551-P1-41

**LT-130/230**
Level Transmitter
Model: Echosonic 11 LU27

**pH-110/120/210/220**
pH Meter
Model: Walchem WEL-PHF-NN

**LEGEND:**

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge
- Static Mixer
- Gate Valve
- Pressure Relief Valve
- Ball Valve
- Sample Port
- Flow Meter
- Level Switch
- pH Sensor
- Level Transmitter

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
| 0 | Original Issue | April 30, 2018 |
| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
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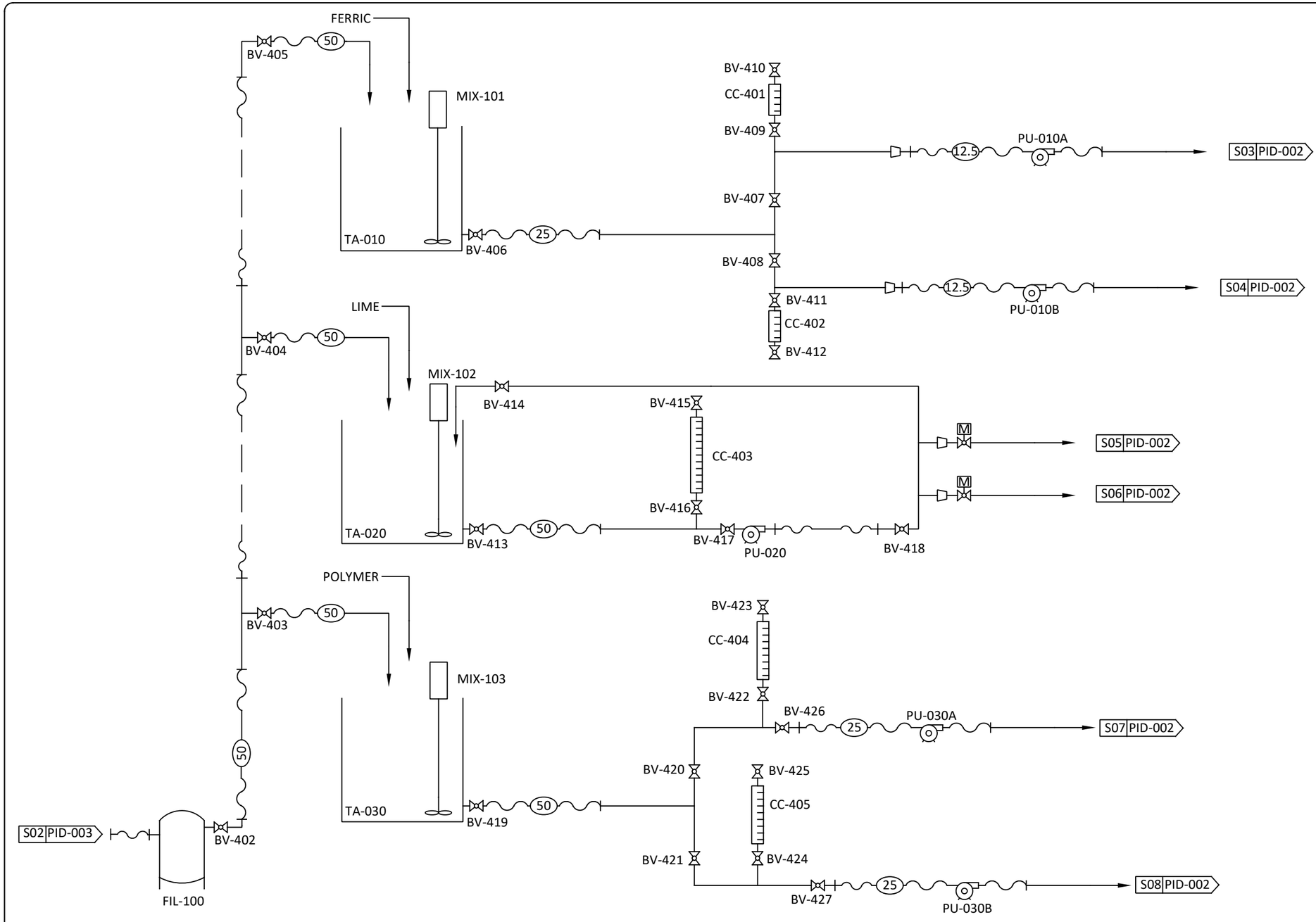
McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

# REACTION TANKS
## PROCESS & INSTRUMENTATION DIAGRAM
**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-0002 |




**LEGEND:**

- Hose
- Sch. 80 PVC Pipe
- Ball Valve
- Reducer
- Motorized Ball Valve

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
| 0 | Original Issue | April 30, 2018 |
| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
| | | |

McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

**CHEMICAL MAKEUP**
**PROCESS & INSTRUMENTATION DIAGRAM**
**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-003 |

FIL-100
Bag Filter
Model: FTI 830-2P-150-CS-BS-P13-DP
Bag Size: 5 Micron

PU-010A/B
Ferric Chemical Pump
Model: Welchmen EHE31E1-VC
Power: 115 VAC/1hp/60Hz
Capacity: 21 LPM @ 106m TDH

PU-020
Lime Chemical Pump
Model: Flowmotion FR25-HR30HR
Power: 230V/3hp/60Hz
Capacity: 570 LPM @ 42m TDH

PU-030
Polymer Chemical Pump
Model: Flowmotion FR25-HR30HR
Power: 230V/3hp/60Hz
Capacity: 990 LPM @ 42m TDH

MIX-101
Ferric Mixer
Model: Dynamix DMX-5505K-1
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 41" Long

MIX-102
Lime Mixer
Model: Dynamix DMX-5505K-2
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 52" Long

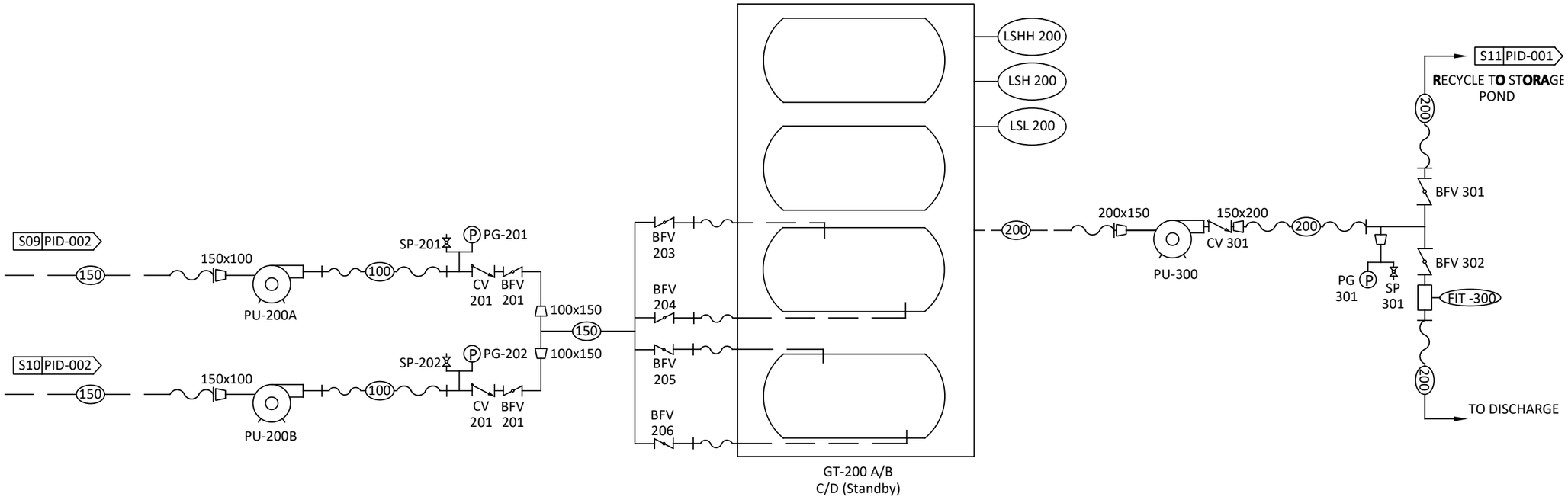
MIX-103
Polymer Mixer
Model: Dynamix DMX-5505K-1
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 49" Long

TA-010
Ferric Mixing Tank
Material: Polyurethane
Size: Ø 1.2m x 1.3m Height

TA-020
Lime Mixing Tank
Material: Polyurethane
Size: Ø 1.8m x 1.7m Height

TA-030
Polymer Mixing Tank
Material: Polyurethane
Size: Ø 1.6m x 1.6m Height

CC-401/402/403/404/405
Calibration Column




**PU-200A/B**
Transfer Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 140m³/hr

**GT-200 A/B/C/D**
Geotube
Model: Tencare GT500
Dimensions: 60' Circumference x 100' Long

**PU-300**
Discharge Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 280m³/hr

**FT-300**
Flow Meter
Model: Toshiba GFG32

**LEGEND:**

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge
- Sample Port
- Level Switch

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
| 0 | Original Issue | April 30, 2018 |
| 1 | Record Drawing | July 31, 2018 |
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McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

# GEOTUBE FIELD PROCESS & INSTRUMENTATION DIAGRAM

**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-004 |

# APPENDIX B - MONITORING

McCUE ENGINEERING CONTRACTORS EST. 2000

BROWNFIELDS TO GOLD MINES

Monitoring Spreadsheet

Project Name: BaffinLand Iron Mine
Waste Pile Water Treatment

| Date | Time | OP | Inlet Quality | | | Train 1 | | | | | | Train 2 | | | | | | Discharge | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Temp ºC | Inlet pH | Inlet TSS mg/L | FIT-100 (L/s) | pH-110 | pH-120 | Ferric Dosage Stroke/Speed | Lime Dosage Hz | Polymer Dosage Hz | FIT-200 (L/s) | pH-210 | pH-220 | Ferric Dosage Stroke/Speed | Lime Dosage Hz | Polymer Dosage Hz | FIT-300 (gpm) | FIT-300 Totalizer (gpm) | Geotube Pond pH | Geobag 1 Height (m) | Geobag 2 Height (m) | Discharge pH | Discharge Turbidity NTU | Discharge TSS (mg/L) |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |

# Appendix K – BAF-PH1-830-P16-0047– Metal and Diamond Mining Effluent Regulations Emergency Response Plan

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# Baffinland Iron Mines Corporation

## METAL AND DIAMOND MINING EFFLUENT REGULATIONS EMERGENCY RESPONSE PLAN

## BAF-PH1-830-P16-0047

## Rev 2

**Prepared By:** Connor Devereaux
**Department:** Environment
**Title:** Environmental Superintendent
**Date:** February 27, 2019

**Signature:**

**Approved By:** Gerald Rogers
**Department:** Operations
**Title:** General Manager
**Date:** February 27, 2019

**Signature:**


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# DOCUMENT REVISION RECORD

| Issue Date MM/DD/YY | Revision | Prepared By | Approved By | Issue Purpose |
|---|---|---|---|---|
| 01/15/18 | 0 | BW | WB | Use |
| 01/30/18 | 1 | BW | GR | Use |
| 02/27/19 | 2 | CD | GR | Use |
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# 1 PURPOSE

In accordance with Part 3, Section 30 of the Metal and Diamond Mining Effluent Regulations (MDMER), Baffinland Iron Mines Corporation (Baffinland) has prepared an MDMER Emergency Response Plan.

Revisions to this plan shall be completed based on future modifications to the work scope, emergency and spill response procedures, and the associated approvals. Updates to this Plan shall be completed in accordance with: the terms and conditions of Metal and Diamond Mining Effluent Regulations, Baffinland's water licenses, QIA Commercial Lease (Q13C301; issued September 6, 2013), the amended Project Certificate No. 005 [issued May 28, 2014 by the Nunavut Impact Review Board (NIRB)] and any subsequent requirements that may be issued.

# 2 SCOPE

Baffinland's Emergency Response Plan (ERP) (BAF-PH10840-P16-0002 r2) identifies potential environmental, health, and safety emergencies that could arise during the construction and operation phases of the Mary River Project. The ERP establishes the framework for responding to these situations, and applies to all facets of the Mary River Project. It defines requisite organizational roles and responsibilities for project personnel, internal and external contact information, training, resources, and reporting requirements. All Baffinland employees and project contractors are required to comply with the ERP.

Baffinland has two ponds subject to the MDMER, both located at the Mine Site. Baffinland identifies the Waste Rock Facility (WRF) Pond as 'MS-08' and the Crusher Facility (CF) Pond as 'MS-06' for MDMER reporting purposes. Both the WRF Pond (MS-08) and the CF Pond (MS-06) are subject to Metal and Diamond Mining Effluent Regulations (MDMER; Appendix B).

The WRF at the Mine Site is located approximately one kilometre east of the Deposit 1 mine (Appendix A), and is the storage location for the mine area's waste rock and overburden. Seepage and runoff from the WRF is intercepted by the drainage diversion ditches and directed downstream into the WRF Pond. Water from the WRF Pond is pumped into the Water Treatment Plant (WTP) for pH adjustment, and subsequently discharged into a Geotube adjacent to the WTP for solids removal via filtering and settling (as per the Waste Pond Water Treatment Plant Operations BAF-PH1-340-PRO-048). The MDMER regulated Final Discharge Point (FDP) for MS-08 is a sampling port located after the discharge pump (Appendix A). Following the FDP, effluent passes through approximately 475 metres (m) of layflat hose and is discharged to the tundra of the approved receiving environment, the Mary River watershed.

The WTP consists of physical-chemical treatment for pH adjustment, chemical precipitation and removal of solids by physical barrier. The water treatment processes include coagulation, pH adjustment and precipitation, flocculation and filtration. Water from the WRF pond is pumped to the first reactor tank

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and mixed by an aeration system. Lime and coagulant (ferric sulfate) solutions are added and pH adjusted to a desired value to assist the precipitation of heavy metals. The intent of coagulation is to neutralize the electric charge on colloidal particles, and assist with precipitation of heavy metals. The coagulated water then enters a second reactor tank to provide additional mixing and retention time for reactions to occur. The pH adjusted water then flows to the third reactor in which polymer is added for flocculation. Flocculation creates flocs to assist with the separation of solids and liquids in subsequent stages. The overflow from the third reactor tank is pumped to the geotube to facilitate the removal of solids via a membrane. The filtered final effluent from the geotubes is then collected in the sump and discharged via layflat hose to the receiving environment if internal effluent water quality is in compliance with the applicable discharge criteria. Effluent that does not comply with the applicable discharge criteria is recirculated to the WRF pond for further treatment.

The treatment system has a 280 m3/hr treatment capacity consisting of two 140 m3/hr treatment trains. For each train, the water flow rate and pH in Reactor tanks 1 and 2 is continuously monitored. Ferric sulfate and polymer is added based on flow rate, while the lime dosage is based on pH in the reactor tank 1. The chemical dose rate is adjusted by the plant operator in the PLC to meet the targets. Monitoring of the treated effluent at various stages of the treatment system is conducted to monitor the treatment system's performance. Effluent discharge volumes are monitored and recorded during periods of discharge through the use of a Krohne Enviromag 6" Magnetic Flow Meter. The frequency and volume of effluent discharges from the WTP is dictated by the pond's capacity, weather, air logistics, sample holding times and treatment requirements. As such, effluent is discharged intermittently on an as-needed basis from approximately late-June to early September. Consequently, the implementation of MDMER effluent and water quality monitoring is restricted to periods of effluent discharge rather than throughout the year due to Project constraints.

The CF is located approximately four kilometres from the WRF (Appendix A). The CF at the Mine Site consists of a pad that houses three (3) crusher spreads as well as associated run-of-mine, lump and fines ore stockpiles. The CF Pond, which collects storm water runoff diverted with drainage diversion ditches around the CF, is located east of the CF. Water from the CF Pond is treated for solids removal via pond-based settling. The MDMER regulated FDP is a sampling port located after the discharge pump to the North of the CF Pond, and before the connection to the sewage effluent pipeline (Appendix A). Following the FDP, effluent from the pond is pumped to the approved Mary River outfall discharge location located approximately 1.3 km southeast of the pond using the Mine Site's treated sewage effluent pipeline, originating at the Mine Site sewage treatment plant. The frequency and volume of effluent discharges from the CF pond is also dictated by the pond's capacity, weather, air logistics, sample holding times and settling requirements. As such, effluent is discharged intermittently on an as-needed basis from approximately late-June to early September. Consequently, the implementation of MDMER effluent and

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water quality monitoring is restricted to periods of effluent discharge rather than throughout the year due to Project constraints.

This MDMER Emergency Response Plan provides a guide for preventing and controlling the release of water outside of the normal course of events for the WRF Pond and CF Pond operations. This Plan has been prepared in accordance with MDMER (Fisheries Act. 2002-2018), and is to be used in conjunction with Baffinland's Emergency Response Plan (BAF-PH1-830-P16-0007) and the Spill Contingency Plan (BAF-PH1-830-P16-0036). Copies of these Plans can be obtained from:

**Baffinland Iron Mines Corporation**
2275 Upper Middle Road East, Suite 300
Oakville, ON L6H 0C3
Tel: (416) 364-8820
Fax: (416) 364-0193

**TABLE 2-1 EXTERNAL CONTACT LIST FOR NOTIFICATION OF A RELEASE**

| | |
|---|---|
| **Department of Environment - Environmental Protection Division**<br>PO Box 1000 Station 200<br>Iqaluit, Nunavut<br>X0A 0H0<br>Tel : (877) 212-6638, (867) 975-6000<br>Fax : (867) 975-6099 | **Environment Climate Change Canada**<br>Enforcement Officer<br>933 Mivvik Street, Suite 301-Qiliaut Building<br>P.O. Box 1870<br>Iqaluit, Nunavut<br>X0A 0H0<br>Tel:(867)-975-4644<br>Cell: (867)-222-1925<br>Fax: (867)-975-4594 |
| **Qikiqtani Inuit Association**<br>Igluvut Building, 2nd Floor<br>PO Box 1340<br>Iqaluit, Nunavut<br>X0A 0H0<br>Tel : (867) 975-8400, 1-800-667-2742<br>Fax : (867) 979-3238 | **Indigenous and Northern Affairs Canada**<br>Field Operations Division<br>PO Box 2200<br>Iqaluit, Nunavut<br>X0A 0H0<br>Tel : (867) 975-4295 (Field Operations Manager)<br>Cell: (867) 222-8458<br>Fax : (867) 975-6445 |
| **Crown-Indigenous Relations and Northern Affairs Canada – Water Resources Division**<br>Building 918, PO BOX 100<br>Iqaluit, Nunavut<br>X0A 0H0<br>Tel : (867) 975-4517 (Water Resources Manager)<br>Fax (867) 975-4560 | **Mittimatalik Hunters and Trappers Organization**<br>PO Box 189<br>Pond Inlet, Nunavut<br>X0A 0S0<br>Tel : (867) 899-8856<br>Fax : (867) 899-8095 |
| **Nunavut Impact Review Board**<br>29 Mitik Street<br>PO Box 1360<br>Cambridge Bay, Nunavut<br>X0B 0C0<br>Tel : 1-866-233-3033<br>Fax : (867) 983-2594, (867) 983-2574 | **Nunavut Water Board**<br>PO Box 119<br>Gjoa Haven, Nunavut<br>X0B 1J)<br>Tel : (867) 360-6338<br>Fax : (867) 360-6369 |

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| | |
|---|---|
| **Hamlet of Pond Inlet**<br>PO Box 180<br>Pond Inlet, Nunavut<br>X0A 0S0<br>Tel : (867) 899-8934, (867) 899-8935<br>Fax : (867) 899-8940 | **Department of Fisheries and Oceans**<br>Central and Arctic Region<br>520 Exmouth Street<br>Sarnia, Ontario<br>N7T 8B1<br>Tel : (519) 383-1813, 1-866-290-3731<br>Fax : (519) 464-5128 |

Baffinland requires all site personnel to be trained on the specific spill response initiation and reporting procedures. Reference Table B: Internal Distribution List for the Emergency Response Plan in the ERP (BAF-PH1-840-P16-0002) for key internal contact information if a spill is discovered. All site personnel must comply with the following procedure upon initiation of a spill response involving a regulated substance:

1. Immediately warn other personnel working near the spill area.
2. Evacuate the area if the health and safety of personnel is threatened.
3. In the absence of danger, and before the spill response team arrives at the scene, take any safe and reasonable measure to stop, contain, and identify the nature of the spill.
4. Notify the Environment and Health and Safety department and the department who owns the facility, who will initiate further spill response operations.

Upon initiation of spill response, as directed by the Head of Health, Safety and Environment or designate, the following procedure shall be completed by the spill response team:

**Source Control** – If safe to do so, reduce or stop the flow of product. This may be accomplished with simple actions such as: turning off a pump; closing a valve; sealing a punctured liner with readily available materials; raising a leaking or discharging hose to stop flow; or transferring product from a leaking container (if required activate Baffinland's Emergency Response Plan BAF-PH1-840-P16-0002).

**Contain and Control the Free Product** – If safe to do so, prevent or minimize the spread of the spilled product. Accumulate/concentrate spilled product in an area to facilitate recovery. Barriers positioned down-gradient of the spill will slow or stop flow of liquid. Barriers can consist of absorbent booms and pads, dykes, berms, fences, and/or trenches (dug in the ground, snow or ice).

**Protection** – Evaluate the risk of the impacted area to the surrounding environment. Protect sensitive ecosystems (i.e. fish-bearing streams) and/or natural resources that are at risk by isolating the area and/or diverting the spilled material to a less sensitive area. Protection/isolation may be achieved through the use of the above mentioned barriers.

**Spill Clean-up** – Recover and dispose of as much product as possible.

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**Report the Spill** – Record information about the spill such as: date and time of occurrence; location and approximate size; type and amount of discharge product; photographic records; actions already taken to stop and contain the spill; ambient conditions; and any perceived threat to humans or the environment. Reports shall be completed as per Baffinland's Incident Investigation Form (BAF-PH1-810-FOR-0005).

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## 2.1 CROSS-REFERENCE OF MDMER REGULATIONS, 30 (1) TO 30(2), TO THIS MDMER EMERGENCY RESPONSE PLAN

| MDMER Reference | Description | Emergency Response Plan Reference |
|---|---|---|
| 30(1) | The owner or operator of a mine shall prepare an emergency response plan that describes the measures to be taken in respect of a deleterious substance within the meaning of subsection 34(1) of the Act to prevent any deposit out of the normal course of events of such a substance or to mitigate the effects of such a deposit. | Entirety of Document |
| 30 (2)(a) | The identification of any deposit out of the normal course of events that can reasonably be expected to occur at the mine and that can reasonably be expected to result in damage or danger to fish habitat or fish or the use by man of fish, and the identification of the damage or danger; | Pages 12 to 16 |
| 30 (2)(b) | a description of the measures to be used to prevent, prepare for and respond to a deposit identified under paragraph (a); | Pages 12 to 17 |
| 30 (2)(c) | a list of the individuals who are to implement the plan in the event of a deposit out of the normal course of events, and a description of their roles and responsibilities; | Pages 9 to 10 |
| 30 (2)(d) | the identification of the emergency response training required for each of the individuals listed under paragraph (c); | Pages 17 to 20 |
| 30 (2)(e) | a list of the emergency response equipment included as part of the plan, and the equipment's location; and | Appendix D |
| 30 (2)(f) | alerting and notification procedures including the measures to be taken to notify members of the public who may be adversely affected by a deposit identified under Section 30 paragraph 2(a). | Table 2-1 |

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# 3 RESPONSIBILITIES

In the event of an emergency associated with the WRF Pond or CF Pond it will be necessary for multiple departments to work in conjunction with each other. The following outlines the specific responsibilities of those departments.

## 3.1 GENERAL MANAGER

The General Manager (GM) is responsible for ensuring that each departmental Manager/Superintendent understands the contents of the plan and follows its requirements. The GM is responsible for ensuring that departments contact the appropriate external authorities as per this Plan and the Baffinland Emergency Response Plan (BAF-PH1-840-P16-0002).

## 3.2 MINE OPERATIONS

### 3.2.1 MINE OPERATIONS MANAGER

The Mine Operations Manager or designate is responsible for implementing the Plan within their department and area of operation. They must ensure that their personnel understand the contents of this Plan and follow its requirements. They are responsible for implementing an inspection program to ensure that the Plan is being fully implemented and to apply corrective actions in the event of identified non-compliances, non-conformances, and/or issues of concern.

#### 3.2.1.1 MINE OPERATIONS SUPERVISOR

The Mine Operations Supervisor is responsible for the following:

- The health and safety of all persons while managing and directing activities associated with the working around the WRF Pond.
- Ensuring all workers and operators are trained and understand this Plan.
- Assist in approved discharging activities.
- Inspections of the WRF and WRF Pond for movement, settlement, or liner damage.
- Inspection of the drainage ditches.

#### 3.2.1.2 MINE OPERATIONS OPERATORS

The Mine Operations Operators have the following responsibilities:

- Report all spills and/ or non-compliances to their supervisor.
- Follow procedures outlined in Waste Pond Water Treatment Plant Operations BAF-PH1-340-PRO-048.
- Understand and follow detailed instructions when assisting with discharging and working around the WRF Pond.
- Ensuring the WRF Pond access road is kept clear of snow during winter months.

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#### 3.2.1.3 WRF WTP OPERATORS

The WRF WTP Operators have the following responsibilities:

- Report all spills and/ or non-compliances to their supervisor.
- Follow procedures outlined in Waste Pond Water Treatment Plant Operations BAF-PH1-340-PRO-048.
- Understand and follow detailed instructions when assisting with discharging and working around the WRF Pond.
- Ensure the internal plant process parameters and field effluent parameters are recorded in the log book daily

## 3.3 CRUSHER OPERATIONS

### 3.3.1 CRUSHER OPERATIONS MANAGER

The Crusher Operations Manager or designate is responsible for implementing the Plan within their department and area of operation. They must ensure that their personnel understand the contents of the plan and follow its requirements. They are responsible for implementing an inspection program to ensure that the Plan is being fully implemented and to apply corrective actions in the event of identified non-compliances, non-conformances, and/or issues of concern.

#### 3.3.1.1 CRUSHER OPERATIONS SUPERVISOR

The Crusher Operations Supervisor is responsible for the following:

- The health and safety of all persons while managing and directing activities associated with the working around the CF Pond.
- Ensuring all workers and operators are trained and understand this plan.
- Assist in approved discharging activities.
- Inspections of the CF area and CF Pond for movement, settlement, or liner damage.

#### 3.3.1.2 CRUSHER OPERATIONS OPERATORS

The Crusher Operations Operators have the following responsibilities:

- Report all spills to their supervisor.
- Understand and follow detailed instructions when assisting with discharging and working around the CF Pond.
- Ensuring the CF Pond access road is kept clear of snow during winter months.

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## 3.4 ENVIRONMENT

### 3.4.1 ENVIRONMENTAL SUPERINTENDENT

The Environmental Superintendent or designate is responsible for implementing the Plan within their department. They must ensure that their personnel understand the contents of the plan and follow its requirements. They are responsible for implementing an inspection program to ensure that the Plan is being fully implemented and advise on how best to evaluate, contain and remediate and/or recover a spill if one should occur associated with the CF Pond and WRF Pond. The Environmental Superintendent is also responsible for all required reporting to regulators regarding WRF Pond and CF Pond water quality, discharging, and spills (Section 6.2) (MDMER, 2018).

### 3.4.2 ENVIRONMENTAL COORDINATORS AND TECHNICIANS

The Environmental Coordinators and Technicians have the following responsibilities:

- Reviewing and understanding all the applicable plans and procedures.
- Contacting their immediate supervisor if uncertain about any of the tasks.
- Inspections of the CF Pond, WRF Pond, and surrounding tundra for:
    - Signs of instability (i.e. collapsing berm, settlement, erosion, cracks, seepage, movement, settlement)
    - Damage to the liner (i.e. tears)
    - Ditches unobstructed and functioning as per design
- Monitoring and sampling of the Final Discharge Point (FDP) during discharge of the CF Pond and WRF Pond as per BIM Environment's Water Sampling and Flow Measurement SOP and Working Near Water Containment Facilities SOP.
- Respond to spills that are associated with the CF Pond and WRF Pond in conjunction with the Emergency Response Team and the Department responsible for the facility.

# 4 DEFINITIONS

## 4.1 SPILL

A spill in this ERP is defined as the uncontrolled release of a deleterious substance from its containment into a receiving environment. A deleterious substance is defined as any acutely lethal effluent or any substance that does not meet the criteria in Table 6-2. Under MDMER (2018), Schedule 4 outlines the discharge limits for substances that must be prevented from depositing into the receiving environment. Such releases are potentially hazardous to humans, vegetation, water resources, and aquatic and terrestrial wildlife, both directly and through food web interaction. The severity of impact varies depending on several factors, including: the type and quantity of spilled material; the location of the spill; and the time of year. MDMER discharge limits are used as the standards for risk analysis of CF Pond and

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WRF Pond releases to the environment. As a result, additional levels of spill response have been developed for spills that exceed these MDMER limits. Additional products with the potential for release include hydrocarbon fuels, anti-freeze, or lubricants from machinery.

## 4.2 SPILL PREVENTION

Spill prevention is an effective means of maintaining the safety of site personnel and the environment. Spills are less likely to occur when adhering to the criteria listed below. Inspections of the CF Pond and WRF Pond are conducted by the Mine Operations, Crusher Operations, and the Environmental Department when it is safe to do so. The conditions of the surrounding environment and current understood risk will determine the frequency of inspections, such as: freshet melt; heavy rain events; increasing reservoir levels (with limited freeboard space); and/or changing water quality conditions

## 4.3 FINAL DISCHARGE POINT

The Final Discharge Point (FDP) is the "identifiable discharge point of a mine beyond which the operator of the mine no longer exercises control over the quality of the effluent" (MDMER, 2018). Baffinland has two designated FDPs, one at the WRF Pond and one at the CF Pond where Baffinland has identified that they no longer exercise control over the effluent of the respective pond.

## 4.4 ACUTE LETHALITY

Baffinland's effluent is determined to be acutely lethal if "the effluent at 100% concentration kills more than 50% of the rainbow trout subjected to it for a period of 96 hours, when tested in accordance with the acute lethality test set out in section 14.1" (MDMER, 2018). This acute lethality test is conducted with effluent from the WRF Pond and CF Pond on a monthly basis.

## 4.5 DELETERIOUS SUBSTANCES

Deleterious substances under the MDMER consist of the following:

- Arsenic;
- Copper;
- Cyanide;
- Lead;
- Nickel;
- Zinc;
- Suspended solids; and
- Radium 226.

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# 5 LEVELS OF EMERGENCY SPILL RESPONSE

To effectively manage emergency responses, Baffinland has adopted a tiered emergency classification scheme (Figure 5-1). Each level of emergency, based on its severity, require varying degrees of response, effort, and support. Each level has distinct effects on normal business operations, as well as requirements for investigation and reporting. The ERP details each level of emergency; levels of classification specific to spill response are as follows:

**Level 1 (Low)** – Minor accidental release of a deleterious substance with:

- No threat to public safety; and/or
- Negligible environmental impact to receiving environment.

**Level 2 (Medium)** – Major accidental release of a deleterious substance with:

- Some threat to public safety; and/or
- Potential Moderate environmental impact to receiving environment

**Level 3 (High)** – Uncontrolled hazard which:

- Jeopardizes project personnel safety: and/or
- Potential significant environmental impacts to receiving environment

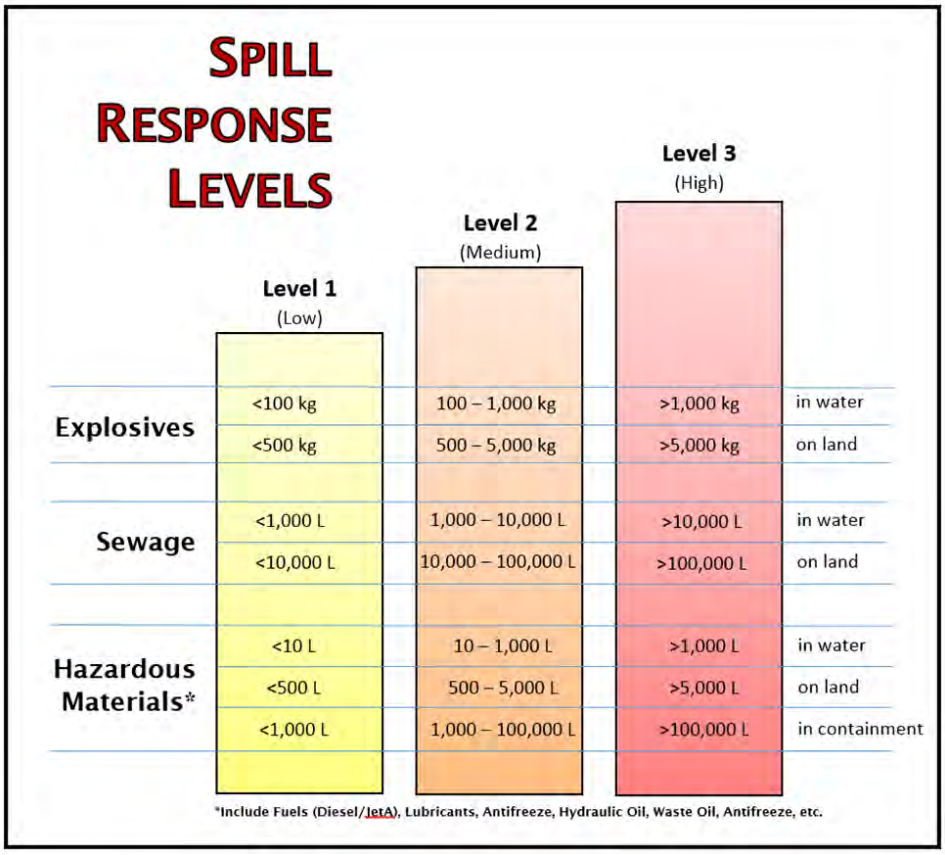



**FIGURE 5-1 EMERGENCY SPILL RESPONSE LEVELS**

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# 6 PROTOCOL

## 6.1 EMERGENCY SPILL RESPONSE PROCEDURES

### 6.1.1 WATERFOWL LANDING IN PONDS

Migratory birds use the Mary River project area during open-water season in their migration routes. The presence of open water in the WRF and CF Pond mimics the natural habitat of some of these birds. This creates the risk of migratory birds landing in the WRF or CF Pond. During occasions when the WRF Pond and CF Pond contain non-compliant water (i.e. low pH), that water poses a hazard to migratory birds if they were to land in the ponds. Harming migratory birds is prohibited under the Migratory Birds Convention Act (1994).

Prevention techniques must be employed to prevent birds from landing in the ponds. These deterrent techniques may include human/ predatory bird effigies or acoustic devices. If birds do land in the ponds, all reasonable efforts must be focused on deterring and removing birds from area. If birds are impacted by any hydrocarbons, dish detergent will be used to clean the birds. In addition, a Wildlife biologist will be consulted further in an event of contamination of birds.

### 6.1.2 SPILLS ON LAND

The main control techniques for spills on land are the use of barriers such as dykes, trenches, booms and fences. Such barriers slow the progression of the spill and also serve as containment to facilitate spill recovery. They should be placed down gradient from the source of the spill, and as close as possible to the source. Depending on the volume spilled, the site of the spill, as well as available material, a dyke may be built with soil, booms, lumber, snow, etc. Construct dykes in such a way as to accumulate a thick layer of free product in a single area (V shaped or U-shaped). Trenches are useful in the presence of permeable soil and when the spilled product is potentially migrating below the ground surface to facilitate spill recovery and/ or containment.

### 6.1.3 BERM INTEGRITY FAILURE

Runoff collected in the CF Pond and WRF Pond can be released into the receiving environment if the integrity of the pond's berm structure(s) is compromised. Factors that can compromise berm integrity include: construction activities; rainfall; berm design; frost heaving; and poor management. If signs of berm failure are noticed during an inspection, Operations, Environment and Health and Safety must be contacted immediately.

In the event of failure of a CF/ WRF Pond berm, a Code 1 should be called immediately, dependent upon the extent. The Emergency Response Team will deploy the emergency spill truck and personnel to help set up pumps, manage water, and help stop/prevent further uncontrolled release of water into the receiving environment. Operations will provide personnel and equipment necessary to seal or hold the

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breach. Departmental Managers and Superintendents of Operations and Environment will provide direction following such an occurrence.

### 6.1.4 DRAINAGE DITCH INTEGRITY FAILURE

In the event of high flows during freshet and heavy rainfalls, the capacity of the drainage diversion ditches that collect runoff from the WRF and CF may be compromised. There is the potential for the water levels in the diversion ditches to rise over the ditch berm height, resulting in an uncontrolled overflow into the receiving environment. A potential result of high water levels in a ditch, even if the ditch berm walls aren't breached, is the seepage of the ditch water through the permeable berms into the surrounding environment (further discussed in Section 6.1.5).

In such an event, immediate corrective actions must aim to ensure all water in the ditches reports to the pond. Controlled pumping from the ditches into the pond may alleviate the volume of water required to be contained by the ditches, and emergency dykes/ berms can be constructed to increase the capacity of the ditch berm. Any water that overflows and does not report to the pond must be sampled with a full suite of water samples.

Preventative efforts must include daily inspections of the drainage diversion ditches at both the WRF and CF. These inspections must include any culvert crossings to ensure water can flow unimpeded through them. Personnel must notify their supervisors of impending overflow situations to enable an effective emergency response.

### 6.1.5 EMERGENCY SPILLWAY

In the event that runoff inflows to the CF Pond and WRF Pond exceed the rate that can be intentionally discharged, for a prolonged period of time, pond water levels may reach an elevation that results in water being released to the receiving environment via the pond's engineered emergency spillway. In such an event, the first mitigation measure that will be implemented to prevent such occurrence will involve performing an emergency controlled discharge. The plan to conduct an emergency controlled discharge will be formulated by the Operations and Environmental Managers/Superintendents. If the controlled emergency discharge does not lower the level of water contained in the pond(s), the emergency spillway will be used, as designed, to release volumes of water that exceeds the capacity of the pond and prevent the failure of the pond's berm structures. In such an occurrence, close monitoring of the pond and spillway is required to assess any erosional degradation of the pond, spillway and surrounding tundra. Monitoring to be conducted in the event that the emergency spillway is used will include inspecting pond infrastructure and adjacent tundra area for cracks, slumping, movement and/or sinkholes. As the level of control is significantly less utilising the emergency spillway, a controlled emergency discharge is the first and preferred measure to be undertaken. If signs of instability or erosional degradation are noticed during a spillway discharge, the Mine Operations, Crushing and Environmental Superintendents should be notified immediately.

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In the event of a controlled emergency or spillway discharge, a full suite sample set (BIM-MMER-WT) group and acute toxicity sample (Group 3) will be collected to determine the quality of the water being discharged to the receiving environment. Volumes of water released during such an event will be measured using a flowmeter or suitable estimation method (i.e. flowrate extrapolation) and recorded.

### 6.1.6 SEEPAGE

The potential exists that excessive precipitation and runoff at the WRF or CF could saturate the underlying substrate and result in the release of seepage outside of the containment areas via active-layer groundwater flow that does not report to the ponds. This groundwater flow could not be captured by the keyed in pond liner and therefore flow through the substrate to the surrounding environment. Another potential effect of excessive precipitation and runoff is high water levels in the drainage diversion ditches, allowing water to seep through permeable berm walls into the surrounding environment.

Close monitoring of the areas surrounding the WRF and CF will be conducted during the open water season. Inspections will look to identify newly formed wet areas, flowing water, and/or areas of pooling. If suspected seepage is observed, the Operations and Environmental Superintendents will be notified immediately. If seepage is confirmed, all reasonable and safe emergency containment methods must be implemented to capture the seepage and/or minimize the extent of seepage migration. For example, an emergency containment ditch and sumps may be utilized to capture observed seepage. This seepage must be pumped back into the pond, and any seepage that can't be contained will be sampled with a full suite sample set to determine potential impacts on the receiving environment.

### 6.1.7 SPILLS INTO CONTAINMENT FACILITY

If hazardous products (i.e. hydrocarbons, etc.) are released into the CF Pond and WRF Pond, spill response should be initiated as outlined in Section 2 of this Plan. To determine the best method for spill clean-up/ recovery, the Environmental Superintendent or their designate should be consulted. Responses to a spill in a pond can include various containment and recovery techniques, including skimming and booming, in concert with water treatment. Mechanical recovery equipment (i.e., skimmers and oil/water separators) will be utilized, as required.

### 6.1.8 SPILLS AT THE WRF WATER TREATMENT PLANT

The water from the WRF Pond is treated in the WTP in a three step process involving the injection of chemical into temporary storage tanks, and a final step of filtration in the Geotube. Further protocols on plant operation and management can be found in Appendix F Waste Rock Pile Water Treatment Plant Operations (BAF-PH1-340-PRO-048). The water is first treated in the temporary storage tanks using iron precipitation, hydroxide precipitation and flocculation, with pH readings monitored to indicate when the pH has reached desired values. With a desired pH value, the water is discharged from the WTP into the Geotube for further treatment of suspended solids. The water from the Geotube sump can be discharged

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either back into the WRF Pond if deemed non-compliant after settling, or out into the receiving environment if compliant (refer to section 6.3.1 and 6.3.2 for guidance on this decision).

Chemicals used during the treatment of the WRF Pond water include ferric sulphate, lime and polymer. Additionally, there is fuel and other hydrocarbon products present at the plant for heating and power purposes. These hazardous products would necessitate spill response if released into the environment. Figure 5-1 should be consulted to determine the level of Emergency Spill Response.

## 6.2 REPORTING REQUIREMENTS IN THE EVENT OF A SPILL

In the event of a spill of deleterious substances from one of WRF or CF ponds, the spill report submitted by the Environmental Superintendent to applicable regulators (Table 6-1) must contain the following information:

- "The name, description and concentration of the deleterious substance deposited;
- The estimated quantity of the spill and how this estimate was achieved;
- The day on which, and hour at which, the deposit occurred;
- The quantity of the deleterious substance that was deposited at a place other than through a final discharge point and the identification of that place, including the location by latitude and longitude and, if applicable, the civic address;
- The quantity of the deleterious substance that was deposited through a final discharge point and the identification of that discharge point;
- The name of the receiving body of water, if there is a name, and the location by latitude and longitude where the deleterious substance entered the receiving body of water;
- The results of the acute lethality tests conducted under subsection 31.1(1) or a statement indicating that acute lethality tests were not conducted but that notification was given under subsection 31.1(2);
- The circumstances of the deposit, the measures that were taken to mitigate the effects of the deposit and, if the emergency response plan was implemented, details concerning its implementation; and
- The measures that were taken, or that are intended to be taken, to prevent any similar occurrence of an unauthorized deposit." (MDMER, 2018)

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**TABLE 6-1 CONTACT LIST FOR MDMER NOTIFICATION OF A RELEASE**

| Name | Location | Phone Number | Purpose |
|---|---|---|---|
| Environmental Superintendent and Head of Health, Safety, Environment & Security | Mary River Mine site | 416-364-8820 x6016 | All spills, leaks and releases of hazardous materials will be reported to the Environment Department immediately and documented by submitting the necessary documentation within 4 hours of the spill. |
| Environment and Climate Change Canada | 933 Mivvik Street, Suite 301-Qiliaut Building P.O. Box 1870 Iqaluit, Nunavut X0A 0H0 | Tel: (867)-975-4644 Cell: (867)-222-1925 Fax: (867)-975-4594 | Any release of a deleterious substance or acute toxicity failure will trigger notification. |
| Crown Indigenous Relations and Northern Affairs Canada | Water Resources Officer, P.O. Box 100, Iqaluit, NU X0A 0H0 | 1-867-975-4550 | Spills greater than 100 liters require notification to the regulators within 24 hours of the spill. |
| NT-NU 24-hr Spill Report Line | Iqaluit, NU | 1-867-920-8130 | Spills greater than 100 liters or deposit of a deleterious substance as outlined in MDMER Section 34 require notification to the spill line and documentation submitted within 24 hours of the spill. |

## 6.3 ENSURING NO ACCIDENTAL DISCHARGE OF NON-COMPLIANT WATER

### 6.3.1 PROCEDURE FOR DISCHARGING CONTAINMENT PONDS

All personnel must adhere to the following procedure when planning to discharge a containment pond. If personnel are unsure of a task at any time, the work must cease, and the worker must contact their supervisor.

1. Prior to sampling, the YSI calibration much be checked and the results of this check recorded in the log book.
2. Obtain full-suite pre-discharge samples from pond if discharge is not immediately required to avoid overflow.
3. If pre-discharge sample results are compliant, notify applicable regulators of planned discharge. The sampling date for the monthly acute toxicity sample must be selected and recorded not less than 30 days in advance of collecting the acute toxicity sample.
4. Obtain approval from the Environmental Superintendent or Manager to begin discharging.
5. Prior to pumping, record totalizer values on the flow meter, as well as the time of pump start-up, in the appropriate log book. This is the standard requirement before any pumping occurs.

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**Note:** Baffinland is required to report the total volume of effluent discharged daily and monthly from containment ponds as per the Water License and MDMER.

6. Effluent sampling frequency must adhere to MDMER and Water License Criteria utilizing accredited laboratory analysis, with accompanying field parameters, while discharging.
   a. All discharge samples must be taken from the particular pond's FDP.
   b. YSI readings must accompany all samples, and the BIM assigned YSI equipment number recorded in the field log.
   c. All Acute Toxicity samples must be collected with a BIM-MMER-WT sample set.
7. The containment pond must be inspected daily while discharging.
8. Ensure the appropriate field log is completed daily while discharging. There is one designated field book for each pond, and all notes must be recorded in this.
9. After sample collection, the following actions must be completed as soon as possible:
   a. Photographs of discharge activities and scans of field notes must be documented and the discharge log updated.
   b. Samples are to be stored in the lab refrigerator, or in a cooler with ice.

### 6.3.2 ENSURING NO DISCHARGE OF NON-COMPLIANT WATER

Water discharged to the receiving environment from containment ponds must adhere to MDMER and Baffinland's Water License discharge limits (Table 6-2). Historically, the WRF Pond has contained low pH (acidic) water as result of impacted runoff from the Waste Rock Stockpile. In cases where water contained in the WRF Pond or CF Pond is determined to be non-compliant with applicable discharge limits, water contained in the pond(s) must be treated as per Baffinland's Waste Rock Management Plan (BAF-PH1-830-P16-0029) and Waste Pond Water Treatment Plant Operations (BAF-PH1-340-PRO-048) to ensure compliance with the applicable discharge limits.

It is the responsibility of both the supervisor and the worker to discontinue discharging the ponds, and to notify their supervisor immediately, for any of the following reasons. A re-evaluation of the water quality is required prior to further discharge.

**Reasons to discontinue discharging:**

1. If external lab results for MS-06 (CF Pond) or MS-08 (WRF Pond) effluent are received that exceed the maximum concentrations listed in the 'BIM Internal Limits' column in Table 6-2. These limits are a threshold of conservatism to ensure regulated discharge limits are not exceeded (Table 6-2).

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**TABLE 6-2 BIM STANDARDS FOR EFFLUENT QUALITY DISCHARGE LIMITS FOR MS-06 AND MS-08**

| Parameter | Maximum Authorized Monthly Mean Concentration, as per MDMER | Maximum Concentration In A Grab Sample, as per BIM Internal Limits |
|---|---|---|
| Total Arsenic | 0.50 mg/L | 0.40 mg/L |
| Total Copper | 0.30 mg/L | 0.24 mg/L |
| Total Lead | 0.20 mg/L | 0.16 mg/L |
| Total Nickel | 0.50 mg/L | 0.40 mg/L |
| Total Zinc | 0.50 mg/L | 0.40 mg/L |
| TSS | 15.0 mg/L | 15.0 mg/L |
| Cyanide | 1.00 mg/L | |
| Radium 226 | 0.37 Bq/L | |
| pH | Between 6.0 and 9.5 | Between 6.5 and 9.0 |
| Toxicity | Not acutely toxic (<50% mortality) | |

2. If field pH measurements (i.e. YSI) fall outside the range/limits outlined in the 'BIM Internal Limits' column of Tables 6-2. These field readings are real-time measurements that characterize the water quality of effluent being discharged at that instance. As such, if measured field parameters fall outside of the 'BIM Internal Limits' outlined in Table 6-2, the discharge of effluent to the receiving environment must cease and the worker's supervisor notified.
3. Pumping must stop for at least 12 hours following heavy precipitation or wind events to allow for the pond water to stabilize, any suspended sediments to settle and be re-sampled, unless advised otherwise by the Environmental Superintendent.

If non-compliant water is accidently discharged to the receiving environment, Operations and Environment Departments will work collaboratively to mitigate, evaluate and document possible effects. In the case of the accidental release of non-compliant water, pumping of effluent to the receiving environment must seize immediately and the Head of Health, Safety, Environment and Security, Mine Manager and the Environmental Superintendent must to be notified immediately. In the event of a release of non-compliant water to the receiving environment, all notes, photographs, pumping/discharge times, and water quality data must be compiled for the investigation and the scene of the incident shut down until further instruction.

In the occurrence of an acute toxicity test determining the effluent to be acutely lethal, Baffinland will cease discharge immediately. The inspector will be notified of this non-compliance without delay. Water quality data collected when the acute toxicity sample was collected will be reviewed, and an additional BIM-MMER-WT sample set will be collected with the discharge pump set in recirculation mode. Additionally, reference and exposure area samples will be collected to monitor any impacts on the receiving environment. Reference area sample site for both ponds is MS-08-US, and the exposure area sample site is MS-08-DS for the WRF Pond, and MS-06-DS for the CF Pond. This is outlined in Section 15 of the MDMER. If discharge is not ceased increased frequency of acute lethality testing will occur as per

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Section 15 of the MDMER. In most cases the pond will be recirculated until water quality is confirmed to be compliant before discharge to the receiving environment occurs.

## 6.4 TRAINING FOR SPILL RESPONSE

Emergency spill responses often occur in conjunction with other emergency responses (i.e. an overturned fuel tanker on the Tote Road); to facilitate an efficient response to an emergency, personnel trained to respond to health and safety emergencies shall also be trained in spill response. Baffinland's ERT Coordinator, with support from the Environmental Superintendents, will identify training and resource requirements for personnel involved with emergency spill responses. Emergency spill response training required by this Plan shall be reviewed in conjunction with Baffinland's ERP. Emergency and spill response training shall be updated throughout the lifecycle of Project to ensure the following requirements are fulfilled:

- The requirements of NWT/Nunavut Mines Health and Safety Regulations are met or exceeded.
- Emergency responders can competently operate the equipment employed for spills and other emergencies.
- Emergency responders will undertake practices, drills, and full scale exercises, for responding to emergencies that are plausible on site.

### 6.4.1 DRILLS AND EXERCISES

While drills and exercises can be used for training purposes, their primary function for this Plan is to provide the means of testing the adequacy of the Plan's provisions and the level of readiness of response personnel. The Emergency Response Trainer and Environmental Superintendents are responsible for coordinating the development of and assisting in conducting drills and exercises annually. The following section outlines the types of drills and exercises that can be practiced:

#### 6.4.1.1 TABLE TOP EXERCISES

Table top exercises involve presenting a simulated emergency situation to key emergency response personnel in informal settings to elicit constructive discussions as the participants examine and resolve problems based on this Plan. These exercises shall be performed during ERT training sessions conducted throughout the year.

#### 6.4.1.2 FUNCTIONAL DRILLS

Functional drills are practical exercises designed to evaluate the capability of personnel to perform a specific function (i.e. communications, first aid, and spill response). Deficiencies and competencies identified during functional drills are documented as per Section 30(4) of MDMER, and used as effective development tools in the preparation of response procedures required for full-scale exercises.

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#### 6.4.1.3 FULL-SCALE EXERCISES

Full scale exercises are intended to evaluate the operational capability of Baffinland's emergency response and preparedness. Full-scale exercises require sufficient notice to allow for the preparation of effective emergency response procedures and to identify and correct deficiencies in advance. Examples of mock full scale exercises at Baffinland include: non-compliant water discharge, berm breach, controlled discharge, seepage observed, and migratory waterfowl landing in ponds. Deficiencies and competencies identified during full scale exercises are documented as per Section 30(4) of MDMER, and used as effective development tools in the preparation of response procedures required for full-scale exercises.

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# 7 REFERENCES AND RECORDS

Baffinland, (2014). EPP: BAF-PH1-840-P16-0002 Emergency Response Plan.

Baffinland, (2014). BAF-PH1-830-P16-0008 Environmental Protection Plan.

Baffinland, BAF-PH1-810-FOR-0005 Incident Investigation Form.

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Baffinland, (2018). BAF-PH1-340-PRO-048 Waste Pond Water Treatment Plant Operations.

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Migratory Birds Convention Act, (1994). (S.C. 1994, c. 22).

Nunavut Water Board (2013): Water License NO: 2AM–MRY1325 Type “A”.

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# APPENDICES

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# APPENDIX A
# SITE LAYOUT AND WATER LICENCE/ MDMER MONITORING LOCATIONS

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WASTE ROCK STOCKPILE FACILITY

TRANSFER PUMP
VALVE
WATER TREATMENT SYSTEM
MS-08 FDP
MS-08 DISCHARGE LINE OUTFLOW
GEOTUBE POND
CURRENT DITCH

560 000 E
561 500 E
563 000 E
564 500 E
N
7 914 500 N
7 913 000 N
7 911 500 N

WASTE ROCK SEDIMENTATION POND
WASTE ROCK FACILITY (ERP)
WASTE ROCK DUMP BOUNDARY AT THE END OF OPERATION (RAIL PHASE)
TRANSFER PUMP
MS-08 FDP
MS-08 DISCHARGE LINE OUTFLOW
MRTTF-1
PROPOSED FINAL OPEN PIT OUTLINE
110 KM LAYDOWN AREA
MINE HAUL ROAD
D1Q1 QUARRY D1Q1
OPEN PIT DEVELOPMENT
NON-FISH BEARING
WASTE MANAGEMENT FACILITY
EXISTING LAYDOWN AREA
SITE SERVICES GARAGE
KM 97 BORROW LOCATIONS
RAW WATER INTAKE
RAW WATER PUMP HOUSE
MS-HWB-6
MS-HWB-5
MS-HWB-3
MS-HWB-4
MS-HWB-2
MS-HWB-1
BULK FUEL STORAGE FACILITY (BLADDER FARM)
AERODROME APRON
QMR2 QUARRY QMR2
PWSP No. 2
PWSP No. 3
PWSP No. 1
EXPLORATION CAMP FACILITIES
WASTE WATER TREATMENT FACILITY
HELIPAD
POLISHING WASTE STABILIZATION PONDS (PWSPs)
CONSTRUCTION LAYDOWN AREA
CAMP INFRASTRUCTURE
D1Q2 QUARRY D1Q2
AERODROME RUNWAY
NEW ACCOMMODATIONS CAMP
NEW ACCOMMODATIONS CAMP PAD
TRUCK WEIGH SCALE
ORE CRUSHING AND LOADING
MINE OPERATIONS OFFICE
FISH BEARING
E0-10
F0-01
G0-01
MS-08-US
MS-08-DS
POLISHING WASTE STABILIZATION PONDS TREATED WATER DISCHARGE POINT
ORE CRUSHING SEDIMENTATION POND
MS-06 FDP
FISH BEARING
EXPLOSIVE MAGAZINE
E0-03
EXISTING LANDFILL ROAD
EFFLUENT DISCHARGE POINT
EXISTING LANDFILL
EMULSION PLANT
MS-06-DS
E0-21
E0-20

UTILITIES, INCLUDED:
- POWER GENERATION MODULE
- FUEL TANK FARM & DYKE
- SEWAGE TREATMENT PLANT
- POTABLE WATER TREATMENT PLANT

SITE SERVICE FACILITIES, INCLUDING:
- MAINTENANCE BUILDING
- WELDING WORKSHOP
- TRUCK WASH STATION
- TOROMONT SHOP
- EMERGENCY RESPONSE OFFICE

LEGEND:
- INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS
- INUIT OWNED LAND - SURFACE AND SUBSURFACE INCLUDING MINERALS
- WATER
- BORROW AREAS (2013 UNDER Q10C3001)
- QUARRY AREA (EXISTING UNDER Q13C301)
- RIVER/STREAM/DRAINAGE
- ROAD
- QIA SURFACE COMMERCIAL LEASE BOUNDARY
- LAY FLAT HOSE
- FISH BEARING WATER
- NON-FISH BEARING WATER
- HDPE PIPE
- OVERLAND SURFACE WATER FLOW
- WATER QUALITY MONITORING LOCATION
- PUMP
- DRAINAGE DIRECTION

NOTES:
1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 13, 2015).
4. CONTOUR INTERVAL IS 2.5 METRES.

SCALE A: 300 150 0 500 1000 1500 m

Baffinland

MARY RIVER PROJECT

MINE SITE LAYOUT AND MDMER / WATER LICENCE MONITORING LOCATIONS

Knight Piésold CONSULTING

PIA NO: NB102-181/45
REF NO: NB18-00875
FIGURE 1
REV: 0

| REV | DATE | DESCRIPTION | DESIGNED | DRAWN | REVIEWED |
|---|---|---|---|---|---|
| 0 | 17DEC'18 | ISSUED WITH TRANSMITTAL | CB | AS | AV |

SAVED: I:\1\02\00181\45\A\acad\FIGS\B00 R0, 12/17/2018 3:50:47 PM, ASIMPSON, PRINTED, 12/17/2018 3:52:44 PM, Layout1, ASIMPSON
XREF FILE(S): QMR2 QMR1 - BOUNDARY LIMIT AND MINING LIMIT Contours 2.5m, Watercourse_to_Mine_Site_v2.0.dwg, 2008 MINE SITE LAYOUT_R0.dwg, 2018 MINE SITE LAYOUT_R0.dwg, MDN_UTC_2018, XAN-TOPO-BASE-LAND-USE--CLAS, IMAGE FILE(S): GIS Baffinland Logo many_river_wo3073_wr2_wr3_wr1_site26 many_river_wo3073_wr2_wr3_wr1_site27

# APPENDIX B
# METAL AND DIAMOND MINING EFFLUENT REGULATIONS


The information contained herein is proprietary to Baffinland Iron Mines Corporation and is used solely for the purpose for which it is supplied.
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CANADA

CONSOLIDATION

CODIFICATION

# Metal and Diamond Mining Effluent Regulations

# Règlement sur les effluents des mines de métaux et des mines de diamants

SOR/2002-222

DORS/2002-222

Current to July 5, 2018

Last amended on June 1, 2018

À jour au 5 juillet 2018

Dernière modification le 1 juin 2018

Published by the Minister of Justice at the following address:
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Publié par le ministre de la Justice à l'adresse suivante :
http://lois-laws.justice.gc.ca

## OFFICIAL STATUS OF CONSOLIDATIONS

Subsections 31(1) and (3) of the *Legislation Revision and Consolidation Act*, in force on June 1, 2009, provide as follows:

**Published consolidation is evidence**
**31 (1)** Every copy of a consolidated statute or consolidated regulation published by the Minister under this Act in either print or electronic form is evidence of that statute or regulation and of its contents and every copy purporting to be published by the Minister is deemed to be so published, unless the contrary is shown.

...

**Inconsistencies in regulations**
**(3)** In the event of an inconsistency between a consolidated regulation published by the Minister under this Act and the original regulation or a subsequent amendment as registered by the Clerk of the Privy Council under the *Statutory Instruments Act*, the original regulation or amendment prevails to the extent of the inconsistency.

## NOTE

This consolidation is current to July 5, 2018. The last amendments came into force on June 1, 2018. Any amendments that were not in force as of July 5, 2018 are set out at the end of this document under the heading "Amendments Not in Force".

## CARACTÈRE OFFICIEL DES CODIFICATIONS

Les paragraphes 31(1) et (3) de la *Loi sur la révision et la codification des textes législatifs*, en vigueur le 1er juin 2009, prévoient ce qui suit :

**Codifications comme élément de preuve**
**31 (1)** Tout exemplaire d'une loi codifiée ou d'un règlement codifié, publié par le ministre en vertu de la présente loi sur support papier ou sur support électronique, fait foi de cette loi ou de ce règlement et de son contenu. Tout exemplaire donné comme publié par le ministre est réputé avoir été ainsi publié, sauf preuve contraire.

[...]

**Incompatibilité — règlements**
**(3)** Les dispositions du règlement d'origine avec ses modifications subséquentes enregistrées par le greffier du Conseil privé en vertu de la *Loi sur les textes réglementaires* l'emportent sur les dispositions incompatibles du règlement codifié publié par le ministre en vertu de la présente loi.

## NOTE

Cette codification est à jour au 5 juillet 2018. Les dernières modifications sont entrées en vigueur le 1 juin 2018. Toutes modifications qui n'étaient pas en vigueur au 5 juillet 2018 sont énoncées à la fin de ce document sous le titre « Modifications non en vigueur ».

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SOR/2002-222 June 6, 2002

FISHERIES ACT

**Metal and Diamond Mining Effluent Regulations**

P.C. 2002-987 June 6, 2002

Her Excellency the Governor General in Council, on the recommendation of the Minister of Fisheries and Oceans, pursuant to subsections 34(2), 36(5) and 38(9) of the *Fisheries Act*, hereby makes the annexed *Metal Mining Effluent Regulations*.

Enregistrement
DORS/2002-222 Le 6 juin 2002

LOI SUR LES PÊCHES

**Règlement sur les effluents des mines de métaux et des mines de diamants**

C.P. 2002-987 Le 6 juin 2002

Sur recommandation du ministre des Pêches et des Océans et en vertu des paragraphes 34(2), 36(5) et 38(9) de la *Loi sur les pêches*, Son Excellence la Gouverneure générale en conseil prend le *Règlement sur les effluents des mines de métaux*, ci-après.

# Metal and Diamond Mining Effluent Regulations

# Règlement sur les effluents des mines de métaux et des mines de diamants

## PART 1

# General

## Interpretation

**1 (1)** The following definitions apply in these Regulations.

***Act*** means the *Fisheries Act*. (*Loi*)

***acute lethality test*** [Repealed, SOR/2018-99, s. 2]

***acutely lethal***, in respect of an effluent, means that the effluent at 100% concentration kills

**(a)** more than 50% of the rainbow trout subjected to it for a period of 96 hours, when tested in accordance with the acute lethality test set out in section 14.1; or

**(b)** more than 50% of the threespine stickleback subjected to it for a period of 96 hours, when tested in accordance with the acute lethality test set out in section 14.2. (*létalité aiguë*)

***acutely lethal effluent*** [Repealed, SOR/2018-99, s. 2]

***authorization officer*** [Repealed, SOR/2018-99, s. 2]

***commercial operation***, in respect of a mine, means an average rate of production equal to or greater than 10% of the design-rated capacity of the mine over a period of 90 consecutive days. (*exploitation commerciale*)

***composite sample*** means

**(a)** a quantity of effluent consisting of not less than three equal volumes or three volumes proportionate to flow that have been collected at approximately equal time intervals over a sampling period of not less than seven hours and not more than 24 hours; or

**(b)** a quantity of effluent collected continuously at a constant rate or at a rate proportionate to the rate of flow of the effluent over a sampling period of not less than seven hours and not more than 24 hours. (*échantillon composite*)

## PARTIE I

# Dispositions générales

## Définitions et interprétation

**1 (1)** Les définitions qui suivent s'appliquent au présent règlement.

***agent d'autorisation*** [Abrogée, DORS/2018-99, art. 2]

***autorisation transitoire*** [Abrogée, DORS/2018-99, art. 2]

***chantier*** [Abrogée, DORS/2018-99, art. 2]

***concentration moyenne mensuelle*** La valeur moyenne des concentrations mesurées dans les échantillons composites ou instantanés prélevés de chaque point de rejet final chaque mois où il y a rejet de substances nocives. (*monthly mean concentration*)

***dépôt de résidus miniers*** [Abrogée, DORS/2006-239, art. 1]

***eau de drainage superficiel*** [Abrogée, DORS/2018-99, art. 2]

***échantillon composite***

**a)** Soit le volume d'effluent composé d'au moins trois parties égales ou de trois parties proportionnelles au débit, prélevées à intervalles sensiblement égaux, pendant une période d'échantillonnage d'au moins sept heures et d'au plus vingt-quatre heures;

**b)** soit le volume d'effluent prélevé de façon continue à un débit constant ou à un débit proportionnel à celui de l'effluent, pendant une période d'échantillonnage d'au moins sept heures et d'au plus vingt-quatre heures. (*composite sample*)

***échantillon instantané*** [Abrogée, DORS/2018-99, art. 2]

***effluent*** S'entend, selon le cas :

**a)** de l'effluent de bassins de traitement, de l'effluent d'eau de mine, de l'effluent des dépôts de résidus miniers, de l'effluent d'installations de préparation du

***Daphnia magna monitoring test*** [Repealed, SOR/2018-99, s. 2]

***deleterious substance*** [Repealed, SOR/2018-99, s. 2]

***diamond mine*** means any work or undertaking that is designed or is used, or has been used, in connection with a mining or milling activity to produce a diamond or an ore from which a diamond may be produced. It includes any cleared or disturbed area that is adjacent to such a work or undertaking. (*mine de diamants*)

***effluent*** means any of the following:

**(a)** hydrometallurgical facility effluent, milling facility effluent, mine water effluent, tailings impoundment area effluent, treatment pond effluent or treatment facility effluent other than effluent from a sewage treatment facility; or

**(b)** any seepage or surface runoff containing any deleterious substance that flows over, through or out of the site of a mine. (*effluent*)

***final discharge point***, in respect of an effluent, means an identifiable discharge point of a mine beyond which the operator of the mine no longer exercises control over the quality of the effluent. (*point de rejet final*)

***grab sample*** [Repealed, SOR/2018-99, s. 2]

***hydrometallurgical facility effluent*** means effluent from the acidic leaching, solution concentration and recovery of metals by means of aqueous chemical methods, tailings slurries, and all other effluents deposited from a hydrometallurgical facility. (*effluent d'installations d'hydrométallurgie*)

***hydrometallurgy*** means the production of a metal by means of aqueous chemical methods for acidic leaching, solution concentration and recovery of metals from metal-bearing minerals other than metal-bearing minerals that have been thermally pre-treated or blended with metal-bearing minerals that have been thermally pre-treated. (*hydrométallurgie*)

***metal mine*** means any work or undertaking that is designed or is used, or has been used, in connection with a mining, milling or hydrometallurgical activity to produce a metal or a metal concentrate or an ore from which a metal or a metal concentrate may be produced, as well as any cleared or disturbed area that is adjacent to such a work or undertaking. It includes any work or undertaking, such as a smelter, pelletizing plant, sintering plant, refinery or acid plant, if its effluent is combined with the effluent from a mining, milling or hydrometallurgical minerai, de l'effluent d'installations d'hydrométallurgie ou de l'effluent d'installations de traitement à l'exclusion de l'effluent d'installations de traitement d'eaux résiduaires;

**b)** des eaux d'exfiltration et des eaux de ruissellement qui contiennent une substance nocive et qui coulent sur le site d'une mine ou en proviennent. (*effluent*)

***effluent à létalité aiguë*** [Abrogée, DORS/2018-99, art. 2]

***effluent d'eau de mine*** Dans le cadre d'activités minières, l'eau pompée d'ouvrages souterrains, de compartiments d'extraction par solution ou de mines à ciel ouvert ou l'eau s'écoulant de ceux-ci. (*mine water effluent*)

***effluent d'installations de préparation du minerai*** Boues de stériles, effluent des lixiviats de terrils, effluent de l'extraction par solution et tout autre effluent rejeté à partir d'une installation de préparation du minerai. (*milling facility effluent*)

***effluent d'installations de traitement*** Eau des bassins de polissage, des bassins de traitement, des bassins de décantation, des stations de traitement de l'eau et de toute installation de traitement des effluents miniers. (*treatment facility effluent*)

***effluent d'installations d'hydrométallurgie*** Effluent rejeté à partir d'une installation d'hydrométallurgie, notamment effluent de lixiviation acide, de concentration de solution et de récupération de métal par procédés chimiques aqueux et boues de résidus miniers. (*hydrometallurgical facility effluent*)

***essai de détermination de la létalité aiguë*** [Abrogée, DORS/2018-99, art. 2]

***essai de suivi avec bioessais sur la Daphnia magna*** [Abrogée, DORS/2018-99, art. 2]

***exploitant*** Personne qui exploite une mine, qui en a le contrôle ou la garde, ou qui en est responsable. (*operator*)

***exploitation commerciale*** Le taux de production moyen d'une mine qui, au cours d'une période de quatre-vingt-dix jours consécutifs, est égal ou supérieur à 10 % de la capacité nominale de la mine. (*commercial operation*)

***exploitation des placers*** Exploitation minière où le minerai ou les métaux sont extraits de sédiments de cours

activity whose purpose is to produce a metal or a metal concentrate or an ore from which a metal or a metal concentrate may be produced. (*mine de métaux*)

***milling*** means any of the following activities for the purpose of producing a diamond, metal or metal concentrate:

**(a)** the crushing or grinding of ore or kimberlite;

**(b)** the processing of uranium ore or uranium enriched solution; or

**(c)** the processing of tailings. (*préparation du minerai*)

***milling facility effluent*** means tailing slurries, heap leaching effluent, solution mining effluent and all other effluent deposited from a milling facility. (*effluent d'installations de préparation du minerai*)

***mine*** [Repealed, SOR/2018-99, s. 2]

***mine under development*** [Repealed, SOR/2018-99, s. 2]

***mine water effluent*** means, in respect of mining activities, water that is pumped from or flows out of any underground works, solution chambers or open pits. (*effluent d'eau de mine*)

***monthly mean concentration*** means the average value of the concentrations measured in all composite or grab samples collected from each final discharge point during each month when a deleterious substance is deposited. (*concentration moyenne mensuelle*)

***new mine*** [Repealed, SOR/2018-99, s. 2]

***operations area*** [Repealed, SOR/2018-99, s. 2]

***operator*** means any person who operates, has control or custody of or is in charge of a mine. (*exploitant*)

***placer mining*** means a mining operation that extracts minerals or metals from stream sediments by gravity or magnetic separation. (*exploitation des placers*)

***recognized closed mine*** [Repealed, SOR/2018-99, s. 2]

***Reference Method EPS 1/RM/10*** means *Biological Test Method: Reference Method for Determining Acute Lethality Using Threespine Stickleback*, published in December 2017 by the Department of the Environment, as amended from time to time. (*méthode de référence SPE 1/RM/10*)

d'eau par gravité ou par séparation magnétique. (*placer mining*)

***hydrométallurgie*** La production d'un métal par des procédés chimiques aqueux de lixiviation acide, concentration de solution et récupération de métal à partir de minéraux métallifères n'ayant pas subi de prétraitement thermique ou n'ayant pas été mélangés à des minéraux métallifères qui ont subi un prétraitement thermique. (*hydrometallurgy*)

***létalité aiguë*** S'agissant d'un effluent à l'état non dilué, la capacité de provoquer, selon le cas, la mort de :

**a)** plus de 50 % des truites arc-en-ciel qui y sont exposées pendant une période de quatre-vingt-seize heures au cours de l'essai de détermination de la létalité aiguë visé à l'article 14.1;

**b)** plus de 50 % des épinoches à trois épines qui y sont exposés pendant une période de quatre-vingt-seize heures au cours de l'essai de détermination de la létalité aiguë visé à l'article 14.2. (*acutely lethal*)

***Loi*** La *Loi sur les pêches*. (*Act*)

***matières en suspension*** Toutes matières solides présentes dans un effluent et retenues sur un papier-filtre dont les pores mesurent 1,5 micron lorsque l'effluent est soumis à un essai conforme aux exigences analytiques prévues au tableau 1 de l'annexe 3. (*suspended solids*)

***méthode de référence SPE 1/RM/10*** La publication intitulée *Méthode d'essai biologique : méthode de référence pour la détermination de la létalité aiguë à l'aide de l'épinoche à trois épines*, publiée en décembre 2017 par le ministère de l'Environnement, avec ses modifications successives. (*Reference Method EPS 1/RM/10*)

***méthode de référence SPE 1/RM/13*** La publication intitulée *Méthode d'essai biologique : méthode de référence pour la détermination de la létalité aiguë d'effluents chez la truite arc-en-ciel* (Méthode de référence SPE 1/RM/13), publiée en juillet 1990 par le ministère de l'Environnement, dans sa version modifiée en décembre 2000 et avec ses modifications successives. (*Reference Method EPS 1/RM/13*)

***méthode de référence SPE 1/RM/14*** La publication intitulée *Méthode d'essai biologique : méthode de référence pour la détermination de la létalité aiguë d'effluents chez Daphnia magna* (Méthode de référence SPE 1/RM/14), publiée en juillet 1990 par le ministère de l'Environnement, dans sa version modifiée en décembre 2000 et avec ses modifications successives. (*Reference Method EPS 1/RM/14*)

***Reference Method EPS 1/RM/13*** means *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout* (Reference Method EPS 1/RM/13), July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time. (*méthode de référence SPE 1/RM/13*)

***Reference Method EPS 1/RM/14*** means *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna* (Reference Method EPS 1/RM/14), July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time. (*méthode de référence SPE 1/RM/14*)

***reopened mine*** [Repealed, SOR/2018-99, s. 2]

***surface drainage*** [Repealed, SOR/2018-99, s. 2]

***suspended solids*** means any solid matter contained in an effluent that is retained on a 1.5 micron pore filter paper when the effluent is tested in compliance with the analytical requirements set out in Table 1 of Schedule 3. (*matières en suspension*)

***tailings impoundment area*** [Repealed, SOR/2006-239, s. 1]

***total suspended solids*** [Repealed, SOR/2018-99, s. 2]

***transitional authorization*** [Repealed, SOR/2018-99, s. 2]

***treatment facility effluent*** means water from a polishing pond, treatment pond, settling pond or water treatment plant or from any mine effluent treatment facility. (*effluent d'installations de traitement*)

***mine*** [Abrogée, DORS/2018-99, art. 2]

***mine de diamants*** Ouvrage ou entreprise qui est conçu ou qui est ou a été utilisé dans le cadre d'activités d'extraction ou de préparation du minerai visant à produire un diamant ou un minerai à partir duquel un diamant peut être produit ainsi que toute zone déboisée ou perturbée qui y est adjacente. (*diamond mine*)

***mine de métaux*** Ouvrage ou entreprise qui est conçu ou qui est ou a été utilisé dans le cadre d'activités d'extraction, d'hydrométallurgie ou de préparation du minerai visant à produire un métal, un concentré de métal ou un minerai à partir duquel un métal ou un concentré de métal peut être produit ainsi que toute zone déboisée ou perturbée qui y est adjacente. La présente définition comprend tout ouvrage ou entreprise, telles les fonderies, usines de bouletage, usines de frittage, affineries et usines d'acide, dont l'effluent est combiné aux effluents provenant d'activités d'extraction, d'hydrométallurgie ou de préparation du minerai visant à produire un métal, un concentré de métal ou un minerai à partir duquel un métal ou un concentré de métal peut être produit. (*metal mine*)

***mine en développement*** [Abrogée, DORS/2018-99, art. 2]

***mine fermée reconnue*** [Abrogée, DORS/2018-99, art. 2]

***mine remise en exploitation*** [Abrogée, DORS/2018-99, art. 2]

***nouvelle mine*** [Abrogée, DORS/2018-99, art. 2]

***point de rejet final*** Le point de rejet de l'effluent d'une mine qui est repérable et au-delà duquel l'exploitant de la mine n'agit plus quant à la qualité de l'effluent. (*final discharge point*)

***préparation du minerai*** S'entend des activités ci-après effectuées en vue de la production d'un diamant, d'un métal ou d'un concentré de métal :

**a)** le concassage ou le broyage d'un minerai ou de kimberlite;

**b)** le traitement du minerai d'uranium ou de solutions uranifères;

**c)** le traitement de résidus miniers. (*milling*)

***rejet*** Est assimilée au rejet l'immersion au sens du paragraphe 34(1) de la Loi. (*French version only*)

***substance nocive*** [Abrogée, DORS/2018-99, art. 2]

**(2)** [Repealed, SOR/2018-99, s. 2]

SOR/2006-239, s. 1; SOR/2009-156, s. 1; SOR/2012-22, s. 1; SOR/2018-99, s. 2.

## Application

**2 (1)** These Regulations apply in respect of the following mines:

**(a)** metal mines that, at any time on or after June 6, 2002,

**(i)** exceed an effluent flow rate of 50 $m^3$ per day, based on the effluent deposited from all the final discharge points of the mine, and

**(ii)** deposit a deleterious substance in any water or place referred to in subsection 36(3) of the Act; and

**(b)** diamond mines that, at any time on or after June 1, 2018,

**(i)** exceed an effluent flow rate of 50 $m^3$ per day, based on the effluent deposited from all the final discharge points of the mine, and

**(ii)** deposit a deleterious substance in any water or place referred to in subsection 36(3) of the Act.

**(2)** However, these Regulations do not apply in respect of

**(a)** placer mining;

**(b)** a metal mine that stopped commercial operation before June 6, 2002, unless it returns to commercial operation on or after that date; and

**(c)** a diamond mine that stopped commercial operation before June 1, 2018, unless it returns to commercial operation on or after that date.

**(3)** Despite subsection (1), sections 4 to 31 do not apply in respect of a mine that is a recognized closed mine under subsection 32(2) unless it returns to commercial operation, in which case it ceases to be a recognized closed mine.

SOR/2012-22, s. 2; SOR/2018-99, s. 3.

***total des solides en suspension*** [Abrogée, DORS/2018-99, art. 2]

**(2)** [Abrogé, DORS/2018-99, art. 2]

DORS/2006-239, art. 1; DORS/2009-156, art. 1; DORS/2012-22, art. 1; DORS/2018-99, art. 2.

## Champ d'application

**2 (1)** Le présent règlement s'applique à l'égard des mines suivantes :

**a)** les mines de métaux qui, à un moment quelconque, le 6 juin 2002 ou après cette date :

**(i)** d'une part, ont un débit d'effluent supérieur à 50 $m^3$ par jour, déterminé d'après les rejets d'effluent à partir de tous leurs points de rejet final,

**(ii)** d'autre part, rejettent une substance nocive dans les eaux ou les lieux visés au paragraphe 36(3) de la Loi;

**b)** les mines de diamants qui, à un moment quelconque, le 1er juin 2018 ou après cette date :

**(i)** d'une part, ont un débit d'effluent supérieur à 50 $m^3$ par jour, déterminé d'après les rejets d'effluent à partir de tous leurs points de rejet final,

**(ii)** d'autre part, rejettent une substance nocive dans les eaux ou les lieux visés au paragraphe 36(3) de la Loi.

**(2)** Toutefois, le présent règlement ne s'applique pas à l'égard :

**a)** des exploitations des placers;

**b)** des mines de métaux dont l'exploitation commerciale a pris fin avant le 6 juin 2002, à moins que l'exploitation commerciale ne reprenne le 6 juin 2002 ou après cette date;

**c)** des mines de diamants dont l'exploitation commerciale a pris fin avant le 1er juin 2018, à moins que l'exploitation commerciale ne reprenne le 1er juin 2018 ou après cette date.

**(3)** Malgré le paragraphe (1), les articles 4 à 31 ne s'appliquent pas à l'égard d'une mine qui est une mine fermée reconnue en application du paragraphe 32(2), à moins que l'exploitation commerciale ne reprenne, auquel cas elle cesse d'être une mine fermée reconnue.

DORS/2012-22, art. 2; DORS/2018-99, art. 3.

## Prescribed Deleterious Substances

**3** For the purpose of the definition *deleterious substance* in subsection 34(1) of the Act, the following substances or classes of substances are prescribed as deleterious substances:

**(a)** arsenic;

**(b)** copper;

**(c)** cyanide;

**(d)** lead;

**(e)** nickel;

**(f)** zinc;

**(g)** suspended solids; and

**(h)** radium 226.

SOR/2018-99, s. 3.

## Substances nocives désignées

**3** Pour l'application de la définition de *substance nocive* au paragraphe 34(1) de la Loi, sont désignées comme substances nocives et les substances ou les catégories de substance suivantes :

**a)** l'arsenic;

**b)** le cuivre;

**c)** le cyanure;

**d)** le plomb;

**e)** le nickel;

**f)** le zinc;

**g)** les matières en suspension;

**h)** le radium 226.

DORS/2018-99, art. 3.

## Authority to Deposit in Water or Place Referred to in Subsection 36(3) of Act

**4 (1)** For the purposes of paragraph 36(4)(b) of the Act, the owner or operator of a mine is authorized to deposit, or to permit the deposit of, an effluent containing any deleterious substance that is prescribed in section 3 in any water or place referred to in subsection 36(3) of the Act if

**(a)** the concentration of the deleterious substance in the effluent does not exceed the maximum authorized concentrations that are set out in columns 2, 3 and 4 of Schedule 4;

**(b)** the pH of the effluent is equal to or greater than 6.0 but is not greater than 9.5; and

**(c)** the effluent is not acutely lethal.

**(2)** The authority in subsection (1) is conditional on the owner or operator complying with sections 6 to 27.

SOR/2018-99, s. 3.

## Rejet autorisé dans les eaux ou lieux visés au paragraphe 36(3) de la Loi

**4 (1)** Pour l'application de l'alinéa 36(4)b) de la Loi, le propriétaire ou l'exploitant d'une mine est autorisé à rejeter ou à permettre que soit rejeté un effluent contenant l'une ou l'autre des substances nocives désignées à l'article 3 dans les eaux ou les lieux visés au paragraphe 36(3) de la Loi, si les conditions suivantes sont réunies :

**a)** la concentration de la substance nocive dans l'effluent ne dépasse pas les concentrations maximales permises qui sont établies aux colonnes 2, 3 et 4 de l'annexe 4;

**b)** le pH de l'effluent est égal ou supérieur à 6,0 mais ne dépasse pas 9,5;

**c)** l'effluent ne présente pas de létalité aiguë.

**(2)** Le propriétaire ou l'exploitant d'une mine ne peut se prévaloir de l'autorisation que lui confère le paragraphe (1) que s'il respecte les conditions prévues aux articles 6 à 27.

DORS/2018-99, art. 3.

## Authority to Deposit in Tailings Impoundment Areas

**5 (1)** Despite section 4, the owner or operator of a mine may deposit or permit the deposit of waste rock, acutely

## Autorisation de rejeter dans un dépôt de résidus miniers

**5 (1)** Malgré l'article 4, le propriétaire ou l'exploitant d'une mine peut rejeter — ou permettre que soient

lethal effluent or effluent of any pH and containing any concentration of a deleterious substance that is prescribed in section 3 into a tailings impoundment area that is either

**(a)** a water or place set out in Schedule 2; or

**(b)** a disposal area that is confined by anthropogenic or natural structures or by both, other than a disposal area that is, or is part of, a natural water body that is frequented by fish.

**(2)** The authority in subsection (1) is conditional on the owner or operator complying with sections 7 to 28.

**(3)** For the purposes of this section, any acutely lethal effluent is prescribed as a deleterious substance.

SOR/2006-239, s. 2; SOR/2018-99, s. 5.

rejetés — des stériles, un effluent à létalité aiguë ou tout autre effluent, quel que soit le pH de l'effluent ou sa concentration en substances nocives désignées à l'article 3, dans l'un ou l'autre des dépôts de résidus miniers suivants :

**a)** les eaux et lieux mentionnés à l'annexe 2;

**b)** toute aire de décharge circonscrite par une formation naturelle ou un ouvrage artificiel, ou les deux, à l'exclusion d'une aire de décharge qui est un plan d'eau naturel où vivent des poissons ou qui en fait partie.

**(2)** Le propriétaire ou l'exploitant d'une mine ne peut se prévaloir de l'autorisation que lui confère le paragraphe (1) que s'il respecte les conditions prévues aux articles 7 à 28.

**(3)** Pour l'application du présent article, tout effluent à létalité aiguë est désigné comme une substance nocive.

DORS/2006-239, art. 2; DORS/2018-99, art. 5.

## PART 2

# Conditions Governing Authority to Deposit

### DIVISION 1

## General

### Prohibition on Diluting Effluent

**6** The owner or operator of a mine shall not combine effluent with water or any other effluent for the purpose of diluting effluent before it is deposited.

### Environmental Effects Monitoring

**7 (1)** The owner or operator of a mine shall conduct environmental effects monitoring studies in accordance with the requirements and within the periods set out in Schedule 5.

**(2)** The studies shall be conducted using documented and validated methods, and their results interpreted and reported on in accordance with generally accepted standards of good scientific practice at the time that the studies are conducted.

## PARTIE 2

# Conditions régissant l'autorisation de rejeter

### SECTION 1

## Dispositions générales

### Interdiction de diluer

**6** Il est interdit au propriétaire ou à l'exploitant d'une mine de combiner un effluent avec de l'eau ou avec tout autre effluent dans le but de le diluer avant son rejet.

### Études de suivi des effets sur l'environnement

**7 (1)** Le propriétaire ou l'exploitant d'une mine effectue des études de suivi des effets sur l'environnement selon les exigences et dans les délais prévus à l'annexe 5.

**(2)** Il effectue les études selon des méthodes éprouvées et validées et évalue et présente leurs résultats conformément aux normes généralement reconnues régissant les bonnes pratiques scientifiques au moment de l'étude.

**(3)** The owner or operator shall record the results of the studies and submit to the Minister of the Environment, in accordance with the requirements set out in Schedule 5, the reports and information required by that Schedule.

SOR/2006-239, s. 3; SOR/2018-99, s. 6.

**(3)** Il enregistre les résultats des études et présente au ministre de l'Environnement, selon les exigences prévues à l'annexe 5, les rapports et les renseignements visés à cette annexe.

DORS/2006-239, art. 3; DORS/2018-99, art. 6.

## Identifying Information

**8 (1)** The owner or operator of a mine shall submit in writing to the Minister of the Environment the information referred to in subsection (2) not later than 60 days after the day on which any of the following occur:

**(a)** the mine becomes subject to these Regulations;

**(b)** ownership of the mine is transferred; and

**(c)** the mine returns to commercial operation after it has become a recognized closed mine.

**(2)** The information that shall be submitted is

**(a)** the name and address of both the owner and the operator of the mine;

**(b)** the name and address of any parent company of the owner and the operator; and

**(c)** the design-rated capacity of the mine, expressed as tonnes per year, and a description and rationale of how the design-rated capacity was determined.

**(3)** The owner or operator shall submit in writing to the Minister of the Environment any change in the information not later than 60 days after the change occurs.

SOR/2018-99, ss. 7, 36.

## Renseignements d'identification

**8 (1)** Le propriétaire ou l'exploitant d'une mine présente par écrit au ministre de l'Environnement les renseignements mentionnés au paragraphe (2) :

**a)** dans les soixante jours suivant la date à laquelle la mine devient assujettie au présent règlement;

**b)** dans les soixante jours suivant le transfert de la propriété de la mine;

**c)** s'agissant d'une mine fermée reconnue, dans les soixante jours suivant la date à laquelle l'exploitation commerciale reprend.

**(2)** Les renseignements à présenter sont :

**a)** les nom et adresse du propriétaire et de l'exploitant;

**b)** les nom et adresse de toute société mère du propriétaire et de l'exploitant;

**c)** la capacité nominale de la mine, exprimée en tonne par année, ainsi qu'une description et une explication de la façon dont elle a été établie.

**(3)** Le propriétaire ou l'exploitant présente par écrit au ministre de l'Environnement des précisions sur tout changement des renseignements dans les soixante jours suivant le changement.

DORS/2018-99, art. 7 et 36.

## Final Discharge Points

**9** The owner or operator of a mine shall identify each final discharge point and submit in writing to the Minister of the Environment, not later than 60 days after the day on which the mine becomes subject to these Regulations, the following information:

**(a)** plans, specifications and a general description of each final discharge point together with its location by latitude and longitude;

**(b)** a description of how each final discharge point is designed and maintained in respect of the deposit of deleterious substances; and

## Points de rejet final

**9** Le propriétaire ou l'exploitant d'une mine détermine chaque point de rejet final et fournit par écrit au ministre de l'Environnement, dans les soixante jours suivant la date à laquelle la mine devient assujettie au présent règlement, les renseignements suivants :

**a)** les plans, les spécifications et une description générale de chaque point de rejet final, ainsi que la latitude et la longitude de son emplacement;

**b)** la façon dont chacun des points de rejet final est conçu et entretenu en ce qui a trait au rejet de substances nocives;

**(c)** the name of the receiving body of water, if there is a name.

SOR/2006-239, s. 4; SOR/2018-99, ss. 8, 36.

**c)** le nom du milieu aquatique récepteur, si ce nom existe.

DORS/2006-239, art. 4; DORS/2018-99, art. 8 et 36.

**10 (1)** The owner or operator of a mine shall submit in writing to the Minister of the Environment the information required by section 9, for

**(a)** any final discharge point that is identified by an inspector, and that was not identified as required by section 9, within 30 days after the discharge point is identified; and

**(b)** each new final discharge point, at least 60 days before depositing effluent from that new final discharge point.

**10 (1)** Le propriétaire ou l'exploitant d'une mine présente par écrit au ministre de l'Environnement les renseignements visés à l'article 9 relativement à :

**a)** tous les points de rejet final que désigne l'inspecteur et qui n'ont pas été déterminés en application de l'article 9, dans les trente jours suivant leur désignation;

**b)** tout nouveau point de rejet final, au moins soixante jours avant qu'un effluent en soit rejeté.

**(2)** The owner or operator shall submit in writing to the Minister of the Environment the information on any proposed change to a final discharge point at least 60 days before the change is to be made.

SOR/2018-99, s. 36.

**(2)** Il présente par écrit au ministre de l'Environnement des précisions sur toute modification proposée d'un point de rejet final au moins soixante jours avant que la modification soit apportée.

DORS/2018-99, art. 36.

### Monitoring Equipment Information

**11** The owner or operator of a mine shall keep records relating to effluent monitoring equipment that contain

**(a)** a description of the equipment and, if applicable, the manufacturer's specifications and the year and model number of the equipment; and

**(b)** the results of the calibration tests of the equipment.

### Renseignements sur l'équipement de surveillance

**11** Le propriétaire ou l'exploitant d'une mine tient un registre concernant l'équipement de surveillance des effluents et y consigne :

**a)** la description de l'équipement et, le cas échéant, les spécifications du fabricant ainsi que l'année et le numéro du modèle de l'équipement;

**b)** les résultats des essais d'étalonnage de l'équipement.

## DIVISION 2

## Effluent Monitoring Conditions

### Deleterious Substance and pH Testing

**12 (1)** The owner or operator of a mine shall, not less than once per week and at least 24 hours apart, collect from each final discharge point a grab sample or composite sample of effluent and record the pH of the sample at the time of its collection and record, without delay after collecting the sample, the concentrations of the deleterious substances prescribed in section 3.

## SECTION 2

## Conditions portant sur le suivi de l'effluent

### Essais concernant le pH et les substances nocives

**12 (1)** Au moins une fois par semaine et à au moins vingt-quatre heures d'intervalle, le propriétaire ou l'exploitant d'une mine prélève, à partir de chaque point de rejet final, un échantillon instantané ou un échantillon composite d'effluent dont il enregistre le pH au moment du prélèvement ainsi que, sans délai après celui-ci, les concentrations des substances nocives désignées à l'article 3.

**(2)** Testing conducted under subsection (1) shall comply with the analytical requirements set out in Table 1 of Schedule 3 and shall be done in accordance with generally accepted standards of good scientific practice at the time of the sampling using documented and validated methods.

**(3)** Despite subsection (1), the owner or operator of a mine is not required to collect samples for the purpose of recording the concentrations of cyanide if cyanide has never been used as a process reagent at the mine.

SOR/2006-239, s. 5; SOR/2018-99, s. 9.

**13 (1)** The owner or operator of a mine may reduce the frequency of conducting tests relating to the concentrations of arsenic, copper, cyanide, lead, nickel or zinc at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one month apart, if that substance's monthly mean concentration at that final discharge point is less than 10% of the value set out in column 2 of Schedule 4 for 12 consecutive months.

**(2)** The owner or operator of a mine, other than an uranium mine, may reduce the frequency of conducting tests relating to the concentration of radium 226 at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one month apart, if the concentration of radium 226 at that final discharge point is less than 0.037 Bq/L for 10 consecutive weeks.

**(3)** The owner or operator of a mine shall increase the frequency of conducting tests relating to the concentration of a deleterious substance at a final discharge point to the frequency prescribed in section 12

**(a)** in the case of a deleterious substance mentioned in subsection (1), if that substance's monthly mean concentration at that final discharge point is equal to or greater than 10% of the value set out in column 2 of Schedule 4; and

**(b)** in the case of radium 226, if the concentration of radium 226 at that final discharge point is equal to or greater than 0.037 Bq/L.

**(4)** The owner or operator of a mine shall increase the frequency of conducting tests relating to the concentration of a deleterious substance at all final discharge points to the frequency prescribed in section 12 for all the substances mentioned in subsections (1) and (2) if the owner or operator

**(a)** fails to perform a test required under those subsections in accordance with the prescribed frequency; or

**(2)** Les essais effectués en application du paragraphe (1) doivent satisfaire aux exigences analytiques prévues au tableau 1 de l'annexe 3 et doivent être effectués conformément aux normes généralement reconnues régissant les bonnes pratiques scientifiques au moment de l'échantillonnage et selon des méthodes éprouvées et validées.

**(3)** Malgré le paragraphe (1), le propriétaire ou l'exploitant d'une mine n'a pas à prélever d'échantillon afin d'enregistrer la concentration de cyanure si cette substance n'a jamais été utilisée comme réactif de procédé à la mine.

DORS/2006-239, art. 5; DORS/2018-99, art. 9.

**13 (1)** Le propriétaire ou l'exploitant d'une mine peut, à un point de rejet final, réduire la fréquence des essais concernant la concentration d'arsenic, de cuivre, de cyanure, de plomb, de nickel ou de zinc à au moins une fois par trimestre civil, chaque essai étant effectué à au moins un mois d'intervalle, si la concentration moyenne mensuelle de la substance à ce point de rejet final est inférieure à 10 % de la valeur établie à la colonne 2 de l'annexe 4 pendant douze mois consécutifs.

**(2)** Le propriétaire ou l'exploitant d'une mine autre qu'une mine d'uranium peut, à un point de rejet final, réduire la fréquence des essais concernant la concentration de radium 226 à au moins une fois par trimestre civil, chaque essai étant effectué à au moins un mois d'intervalle, si la concentration à ce point de rejet final est inférieure à 0,037 Bq/L pendant dix semaines consécutives.

**(3)** Le propriétaire ou l'exploitant d'une mine porte la fréquence des essais concernant la concentration des substances nocives ci-après à celle prévue à l'article 12, à un point de rejet final, si :

**a)** dans le cas d'une substance nocive énumérée au paragraphe (1), la concentration moyenne mensuelle de cette substance, à ce point de rejet final, est égale ou supérieure à 10 % de la valeur établie à la colonne 2 de l'annexe 4;

**b)** dans le cas du radium 226, la concentration de cette substance, à ce point de rejet final, est égale ou supérieure à 0,037 Bq/L.

**(4)** Le propriétaire ou l'exploitant d'une mine porte la fréquence des essais concernant la concentration des substances nocives énumérées aux paragraphes (1) et (2) à celle prévue à l'article 12, à tous les points de rejet final, s'il omet :

**a)** soit d'effectuer les essais visés à ces paragraphes selon la fréquence requise;

**(b)** fails to submit a report required under subsection 21(1) or section 22 within the prescribed time.

**(5)** If the owner or operator of a mine changes the location of a final discharge point, the owner or operator shall increase the frequency of conducting tests relating to the concentration of a deleterious substance at that final discharge point to the frequency prescribed in section 12 for all the deleterious substances mentioned in subsections (1) and (2).

**(6)** The owner or operator of a mine who reduces the frequency of conducting tests under subsection (1) or (2) shall

**(a)** notify the Minister of the Environment, in writing, at least 30 days in advance, of that fact;

**(b)** select and record the sampling dates not less than 30 days in advance of collecting the samples of effluent; and

**(c)** collect the sample on the selected day except if, owing to unforeseen circumstances, they cannot sample on that day, in which case, they shall do so as soon as practicable after that day.

SOR/2006-239, s. 6; SOR/2018-99, s. 9.

**b)** soit de présenter le rapport visé au paragraphe 21(1) ou à l'article 22 dans les délais prescrits.

**(5)** Si un point de rejet final est déplacé, le propriétaire ou l'exploitant d'une mine porte la fréquence des essais concernant la concentration des substances nocives, à ce point de rejet final, à celle prévue à l'article 12 pour toutes les substances nocives énumérées aux paragraphes (1) et (2).

**(6)** Le propriétaire ou l'exploitant d'une mine qui réduit la fréquence des essais en vertu des paragraphes (1) ou (2) prend les mesures suivantes :

**a)** il avise par écrit le ministre de l'Environnement de la réduction de la fréquence des essais, au moins trente jours avant celle-ci;

**b)** il choisit et enregistre, au moins trente jours à l'avance, la date de l'échantillonnage;

**c)** il prélève l'échantillon ce jour-là ou, si des circonstances imprévues l'en empêchent, le plus tôt possible après ce jour.

DORS/2006-239, art. 6; DORS/2018-99, art. 9.

## Acute Lethality Testing

### General

**14 (1)** Subject to section 15, the owner or operator of a mine shall collect, once a month, a grab sample of effluent from each final discharge point and determine whether the effluent is acutely lethal by conducting acute lethality tests on aliquots of each effluent sample in accordance with sections 14.1 and 14.2.

**(2)** For the purposes of subsection (1), the owner or operator of a mine

**(a)** shall select and record the sampling date not less than 30 days in advance of collecting the grab sample;

**(b)** shall collect the sample on the selected day except if, owing to unforeseen circumstances, they cannot sample on that day, in which case, they shall do so as soon as practicable after that day; and

**(c)** shall collect the grab samples not less than 15 days apart.

## Essai de détermination de la létalité aiguë

### Généralités

**14 (1)** Sous réserve de l'article 15, le propriétaire ou l'exploitant d'une mine prélève une fois par mois un échantillon instantané d'effluent à chaque point de rejet final et détermine si cet effluent présente une létalité aiguë en effectuant des essais de détermination de la létalité aiguë sur des portions aliquotes de chaque échantillon conformément aux articles 14.1 et 14.2.

**(2)** Pour l'application du paragraphe (1), le propriétaire ou l'exploitant d'une mine :

**a)** choisit et enregistre, au moins trente jours à l'avance, la date de l'échantillonnage;

**b)** prélève l'échantillon ce jour-là ou, si des circonstances imprévues l'en empêchent, le plus tôt possible après ce jour;

**c)** prélève les échantillons instantanés à au moins quinze jours d'intervalle.

**(3)** When collecting a grab sample of effluent for the purposes of subsection (1), the owner or operator of a mine shall collect a sufficient volume of effluent to enable the owner or operator to comply with paragraph 15(1)(a).

SOR/2006-239, s. 7; SOR/2011-92, s. 4; SOR/2012-22, s. 3; SOR/2018-99, s. 10.

**(3)** Lors du prélèvement des échantillons instantanés en application du paragraphe (1), le propriétaire ou l'exploitant d'une mine prélève un volume d'effluent suffisant pour lui permettre de se conformer à l'alinéa 15(1)a).

DORS/2006-239, art. 7; DORS/2011-92, art. 4; DORS/2012-22, art. 3; DORS/2018-99, art. 10.

### Acute Lethality Test — Rainbow Trout

**14.1** Unless the salinity value of the effluent is equal to or greater than ten parts per thousand and the effluent is deposited into marine waters, the owner or operator of a mine shall determine whether the effluent is acutely lethal by conducting an acute lethality test in accordance with the procedures set out in section 5 or 6 of Reference Method EPS 1/RM/13.

SOR/2018-99, s. 10.

### Essai de détermination de la létalité aiguë — Truite arc-en-ciel

**14.1** Sauf dans le cas où la salinité de l'effluent est égale ou supérieure à dix parties par millier et que l'effluent est rejeté dans l'eau de mer, le propriétaire ou l'exploitant d'une mine détermine si l'effluent présente une létalité aiguë en effectuant un essai de détermination de la létalité aiguë conformément aux modes opératoires prévus aux sections 5 ou 6 de la méthode de référence SPE 1/RM/13.

DORS/2018-99, art. 10.

### Acute Lethality Test — Threespine Stickleback

**14.2** If the salinity value of the effluent is equal to or greater than ten parts per thousand and the effluent is deposited into marine waters, the owner or operator of a mine shall determine whether the effluent is acutely lethal by conducting an acute lethality test in accordance with the procedures set out in section 5 or 6 of Reference Method EPS 1/RM/10.

SOR/2018-99, s. 10.

### Essai de détermination de la létalité aiguë — Épinoche à trois épines

**14.2** Si la salinité de l'effluent est égale ou supérieure à dix parties par millier et que l'effluent est rejeté dans l'eau de mer, le propriétaire ou l'exploitant d'une mine détermine si l'effluent présente une létalité aiguë en effectuant un essai de détermination de la létalité aiguë conformément aux modes opératoires prévus aux sections 5 ou 6 de la méthode de référence SPE 1/RM/10.

DORS/2018-99, art. 10.

## Increased Frequency of Acute Lethality Testing

**15 (1)** If an effluent sample is determined to be acutely lethal by an acute lethality test, the owner or operator of a mine shall

**(a)** without delay, conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample collected under subsection 14(1) and record the concentrations of the deleterious substances prescribed in section 3;

**(b)** collect, from the final discharge point from which the effluent sample that was determined to be acutely lethal was collected, a grab sample twice a month and, without delay after collecting the sample, conduct the acute lethality test that determined the effluent sample to be acutely lethal on each grab sample in accordance with the procedure set out in section 6 of the applicable reference method and, if the sample is determined to be acutely lethal, then conduct the effluent characterization set out in subsection 4(1) of

## Fréquence accrue des essais de détermination de la létalité aiguë

**15 (1)** S'il est établi qu'un échantillon d'effluent présente une létalité aiguë après un essai de détermination de la létalité aiguë, le propriétaire ou l'exploitant d'une mine :

**a)** sans délai, effectue la caractérisation de l'effluent conformément au paragraphe 4(1) de l'annexe 5 sur une portion aliquote de chaque échantillon instantané prélevé en application du paragraphe 14(1) et enregistre les concentrations des substances nocives désignées à l'article 3;

**b)** deux fois par mois, prélève un échantillon instantané à partir du point de rejet final d'où l'échantillon d'effluent qui présente une létalité aiguë a été prélevé et effectue sans délai après le prélèvement, sur chacun de ces échantillons, selon le mode opératoire prévu à la section 6 de la méthode de référence, l'essai de détermination de la létalité aiguë à partir duquel la létalité aiguë de l'échantillon a été établie. S'il est ainsi établi que l'échantillon présente une létalité aiguë, le

Schedule 5 and record the concentrations of the deleterious substances prescribed in section 3; and

**(c)** collect the grab samples not less than seven days apart.

**(2)** The owner or operator may resume sampling and testing at the frequency prescribed in section 14 if the effluent is determined not to be acutely lethal in three consecutive tests conducted under paragraph (1)(b).

SOR/2006-239, s. 8; SOR/2018-99, s. 12.

## Reduced Frequency of Acute Lethality Testing

**16 (1)** The owner or operator of a mine may reduce the frequency of conducting an acute lethality test at a final discharge point to once in each calendar quarter if the effluent from that final discharge point is determined not to be acutely lethal by that acute lethality test for 12 consecutive months.

**(2)** For the purpose of determining whether that effluent is acutely lethal for the 12-month period referred to in subsection (1), the owner or operator of a mine shall use the results of the acute lethality tests conducted under subsection 14(1).

**(3)** The owner or operator of a mine shall notify the Minister of the Environment in writing at least 30 days before the reduction of the frequency of acute lethality testing.

**(4)** The owner or operator who reduces the frequency of conducting acute lethality testing under subsection (1) shall

**(a)** select and record the sampling date not less than 30 days in advance of collecting the grab samples; and

**(b)** collect the grab samples not less than 45 days apart.

**(5)** If a grab sample is determined to be acutely lethal by an acute lethality test when the owner or operator of a mine is testing at the frequency prescribed in subsection (1), the owner or operator shall increase the frequency of conducting that test to the frequency prescribed in section 15 and conduct that test in accordance with that section.

**(6)** If the location of a final discharge point is changed, the owner or operator of a mine shall, at that final discharge point, increase the frequency of conducting all the acute lethality tests to the frequency prescribed in

propriétaire ou l'exploitant d'une mine effectue la caractérisation de l'effluent conformément au paragraphe 4(1) de l'annexe 5 et enregistre les concentrations des substances nocives désignées à l'article 3;

**c)** prélève les échantillons instantanés à au moins sept jours d'intervalle.

**(2)** Il peut recommencer à effectuer l'échantillonnage et les essais à la fréquence fixée à l'article 14 si l'effluent ne présente pas de létalité aiguë dans trois essais consécutifs effectués selon l'alinéa (1)b).

DORS/2006-239, art. 8; DORS/2018-99, art. 12.

## Fréquence réduite des essais de détermination de la létalité aiguë

**16 (1)** Le propriétaire ou l'exploitant d'une mine peut réduire à une fois par trimestre civil la fréquence d'un essai de détermination de la létalité aiguë à un point de rejet final si, pendant douze mois consécutifs, l'effluent à ce point de rejet final ne présente pas de létalité aiguë selon cet essai.

**(2)** Pour établir si l'effluent présente une létalité aiguë pendant la période de douze mois visée au paragraphe (1), le propriétaire ou l'exploitant d'une mine se fonde sur les résultats obtenus aux termes du paragraphe 14(1).

**(3)** Le propriétaire ou l'exploitant d'une mine avise par écrit le ministre de l'Environnement de la réduction de la fréquence des essais au moins trente jours avant celle-ci.

**(4)** Le propriétaire ou l'exploitant qui réduit la fréquence des essais en application du paragraphe (1) prend les mesures suivantes :

**a)** il choisit et enregistre, au moins trente jours à l'avance, la date de l'échantillonnage;

**b)** il prélève les échantillons instantanés à au moins quarante-cinq jours d'intervalle.

**(5)** S'il est établi qu'un échantillon instantané d'effluent présente une létalité aiguë selon un essai de détermination de la létalité aiguë alors que cet essai est effectué à la fréquence prévue au paragraphe (1), le propriétaire ou l'exploitant d'une mine porte la fréquence de cet essai à celle prévue à l'article 15 et effectue cet essai conformément à cet article.

**(6)** Si l'emplacement d'un point de rejet final est déplacé, le propriétaire ou l'exploitant d'une mine porte la fréquence de tous les essais de détermination de la létalité aiguë à ce point de rejet final à celle prévue au

subsection 14(1) and conduct those tests in accordance with that subsection.

SOR/2012-22, s. 4; SOR/2018-99, s. 14.

paragraphe 14(1) et effectue ces essais conformément à ce paragraphe.

DORS/2012-22, art. 4; DORS/2018-99, art. 14.

## *Daphnia magna* Monitoring Tests

**17 (1)** Unless the salinity value of the effluent is equal to or greater than four parts per thousand and the effluent is deposited into marine waters, the owner or operator of a mine shall conduct *Daphnia magna* monitoring tests in accordance with the procedure set out in section 5 or 6 of Reference Method EPS 1/RM/14 at the same time that the acute lethality tests are conducted under section 14, 15 or 16 of these Regulations.

**(2)** The owner or operator shall conduct *Daphnia magna* monitoring tests on the aliquots of each effluent sample collected for the acute lethality tests.

SOR/2018-99, s. 15.

## Essai de suivi avec bioessais sur la *Daphnia magna*

**17 (1)** Sauf dans le cas où la salinité de l'effluent est égale ou supérieure à quatre parties par millier et que l'effluent est rejeté dans l'eau de mer, le propriétaire ou l'exploitant d'une mine qui fait des essais de détermination de la létalité aiguë en application des articles 14, 15 ou 16 effectue au même moment des essais de suivi avec bioessais sur la *Daphnia magna* selon les modes opératoires prévus aux sections 5 ou 6 de la méthode de référence SPE 1/RM/14.

**(2)** Il effectue chaque essai de suivi sur des portions aliquotes de chaque échantillon d'effluent prélevé pour les essais de détermination de la létalité aiguë.

DORS/2018-99, art. 15.

## Obligation to Record All Test Results

**18** The owner or operator of a mine shall record without delay the data referred to in section 9.1 of Reference Method EPS 1/RM/10, section 8.1 of Reference Method EPS 1/RM/13 and section 8.1 of Reference Method EPS 1/RM/14 for all acute lethality tests and *Daphnia magna* monitoring tests that are conducted to monitor deposits from final discharge points.

SOR/2018-99, s. 16.

## Enregistrement des renseignements

**18** Le propriétaire ou l'exploitant d'une mine enregistre sans délai les données visées à la section 9.1 de la méthode de référence SPE 1/RM/10, à la section 8.1 de la méthode de référence SPE 1/RM/13 et à la section 8.1 de la méthode de référence SPE 1/RM/14 pour tous les essais de détermination de la létalité aiguë et tous les essais de suivi avec bioessais sur la *Daphnia magna* effectués dans le cadre du suivi des rejets provenant de points de rejet final.

DORS/2018-99, art. 16.

## Volume of Effluent

**19 (1)** The owner or operator of a mine shall record, in cubic metres, the total monthly volume of effluent deposited from each final discharge point for each month during which there was a deposit.

**(2)** The total monthly volume of effluent deposited shall be either

**(a)** determined on the basis of the average of the flow rates, expressed in cubic metres per day, measured and calculated as follows:

**(i)** by measuring the flow rate at the same time as samples are collected under section 12,

**(ii)** by calculating the average monthly flow rate by adding the flow rate measurements taken during

## Volume d'effluent

**19 (1)** Le propriétaire ou l'exploitant d'une mine enregistre, en mètres cubes, le volume mensuel total d'effluent rejeté à partir de chaque point de rejet final, pour chaque mois au cours duquel un effluent a été rejeté.

**(2)** Le volume mensuel total d'effluent rejeté est :

**a)** soit fondé sur la moyenne des débits, exprimée en mètres cubes par jour, auquel cas il est déterminé de la façon suivante :

**(i)** le débit est mesuré au moment où les échantillons sont prélevés en application de l'article 12,

the month and dividing the total by the number of times the flow rate was measured, and

**(iii)** by multiplying the average monthly flow rate by the number of days during the month that effluent was deposited; or

**(b)** determined by using a monitoring system that provides a continuous measure of the volume of effluent deposited.

**(3)** The owner or operator shall

**(a)** measure the flow rate or volume of effluent deposited by using a monitoring system that is accurate to within 15% of measured flow rate or volume; and

**(b)** maintain and calibrate the monitoring system at least once in each year and record the results, as well as the date on which and the manner in which the requirement to maintain and calibrate has been met.

SOR/2006-239, s. 9; SOR/2012-22, s. 5; SOR/2018-99, s. 17.

## Calculation of Monthly Mean Concentration and Loading

**19.1 (1)** With respect to the deleterious substances that are contained in the effluent deposited from each final discharge point, the owner or operator of a mine shall, for each month during which there is a deposit and during which samples are collected, record the monthly mean concentration

**(a)** in mg/L for deleterious substances referred to in paragraphs 3(a) to (g); and

**(b)** in Bq/L for a deleterious substance referred to in paragraph 3(h).

**(2)** If the analytical result from any test conducted under section 12 or 13 is less than the method detection limit used for that test, the test result shall be considered to be equal to one half of the detection limit used for the purpose of calculating the monthly mean concentration.

SOR/2006-239, s. 9; SOR/2018-99, s. 18.

**20 (1)** With respect to the deleterious substances that are contained in the effluent deposited from each final discharge point, the owner or operator of a mine shall, for each month and for each calendar quarter during which there was a deposit and during which a sample is collected, record the loading

**(ii)** la moyenne mensuelle des débits est calculée par la division du total des mesures de débit enregistrées au cours du mois par le nombre de mesures prises,

**(iii)** la moyenne mensuelle des débits est multipliée par le nombre de jours où l'effluent a été rejeté;

**b)** soit déterminé à l'aide d'un système de surveillance à mesure continue.

**(3)** Le propriétaire ou l'exploitant mesure le volume ou le débit d'effluent rejeté en tenant compte des exigences suivantes :

**a)** il utilise à cette fin un système de surveillance donnant des mesures exactes à 15 % près;

**b)** il entretient et étalonne le système de surveillance au moins une fois par année et enregistre les résultats, la date à laquelle il s'est conformé à cette exigence ainsi que la manière dont il s'y est pris.

DORS/2006-239, art. 9; DORS/2012-22, art. 5; DORS/2018-99, art. 17.

## Calcul de la concentration moyenne mensuelle et de la charge

**19.1 (1)** À l'égard des substances nocives désignées à l'article 3 se trouvant dans l'effluent rejeté à partir de chaque point de rejet final, le propriétaire ou l'exploitant d'une mine enregistre, pour chaque mois au cours duquel un effluent est rejeté et des prélèvements sont effectués :

**a)** la concentration moyenne mensuelle en mg/L des substances nocives énumérées aux alinéas 3a) à g);

**b)** la concentration moyenne mensuelle en Bq/L de la substance nocive figurant à l'alinéa 3h).

**(2)** Si le résultat analytique de tout essai effectué en application des articles 12 ou 13 est inférieur à la limite de détection de la méthode utilisée pour l'essai, il est considéré comme égal à la moitié de la limite de détection de la méthode utilisée pour le calcul de la concentration moyenne mensuelle.

DORS/2006-239, art. 9; DORS/2018-99, art. 18.

**20 (1)** À l'égard des substances nocives désignées à l'article 3 se trouvant dans l'effluent rejeté à partir de chaque point de rejet final, le propriétaire ou l'exploitant d'une mine enregistre, pour chaque mois et pour chaque trimestre civil au cours duquel un effluent a été rejeté et des prélèvements ont été effectués :

**(a)** in kg for deleterious substances referred to in paragraphs 3(a) to (g); and

**(b)** in MBq for a deleterious substance referred to in paragraph 3(h).

**(2)** The owner or operator shall determine the loading for each month using the following formula:

**ML = C × V / 1,000**

where

**ML** is the loading for a month;

**C** is the monthly mean concentration of the deleterious substance, recorded under section 19.1; and

**V** is the total monthly volume of effluent deposited from each final discharge point, recorded under section 19.

**(3)** The owner or operator shall determine the loading for each calendar quarter using the following formula:

**QL = C × V / 1,000**

where

**QL** is the loading for a calendar quarter;

**C** is the mean of the monthly mean concentrations of the deleterious substance for that calendar quarter, recorded under section 19.1; and

**V** is the total volume of effluent deposited from each final discharge point during that calendar quarter, based on the sum of the total monthly volumes of effluent deposited from each final discharge point, recorded under section 19.

SOR/2006-239, s. 9; SOR/2018-99, s. 19.

## Reporting Monitoring Results

**21 (1)** The owner or operator of a mine shall submit to the Minister of the Environment an effluent monitoring report for all tests and monitoring conducted during each calendar quarter not later than 45 days after the end of the quarter.

**(2)** Subject to subsection (3), the effluent monitoring report shall include

**(a)** the data referred to in section 9.1 of Reference Method EPS 1/RM/10, section 8.1 of Reference Method EPS 1/RM/13 and section 8.1 of Reference Method EPS 1/RM/14 as required by section 18;

**(b)** the concentration and monthly mean concentration of each deleterious substance prescribed in section 3 that is contained in the effluent samples

**a)** la charge en kg des substances nocives énumérées aux alinéas 3a) à g);

**b)** la charge en MBq de la substance nocive figurant l'alinéa 3h).

**(2)** Il détermine la charge pour chaque mois civil selon la formule suivante :

**CM = C × V / 1 000**

où :

**CM** représente la charge pour un mois;

**C** la concentration moyenne mensuelle de la substance nocive enregistrée en application de l'article 19.1;

**V** le volume total d'effluent rejeté à partir de chaque point de rejet final au cours du mois et enregistré en application de l'article 19.

**(3)** Il détermine la charge pour le trimestre civil selon la formule suivante :

**CT = C × V / 1 000**

où :

**CT** représente la charge pour un trimestre;

**C** la moyenne des concentrations moyennes mensuelles de la substance nocive enregistrées au cours du trimestre en application de l'article 19.1;

**V** le volume total d'effluent rejeté à partir de chaque point de rejet final au cours du trimestre, fondé sur la somme des volumes mensuels d'effluent rejeté à partir de chaque point de rejet final et enregistrés en application de l'article 19.

DORS/2006-239, art. 9; DORS/2018-99, art. 19.

## Rapports sur les résultats de suivi

**21 (1)** Le propriétaire ou l'exploitant d'une mine présente au ministre de l'Environnement un rapport sur le suivi de l'effluent pour tout essai ou mesure de suivi effectué au cours de chaque trimestre civil, dans les quarante-cinq jours suivant la fin du trimestre.

**(2)** Sous réserve du paragraphe (3), le rapport comporte ce qui suit :

**a)** les données visées à la section 9.1 de la méthode de référence SPE 1/RM/10, à la section 8.1 de la méthode de référence SPE 1/RM/13 et à la section 8.1 de la méthode de référence SPE 1/RM/14, qu'exige l'article 18;

**b)** la concentration et la concentration moyenne mensuelle des substances nocives désignées à l'article 3 se trouvant dans les échantillons d'effluent prélevés en

collected under subsection 12(1) and the concentrations of such deleterious substances contained in the effluent samples collected under subsection 13(1) or (2);

**(c)** the pH of the effluent samples as required by subsection 12(1);

**(d)** whether a composite or grab sample collection method was used for each effluent sample as required by subsection 12(1);

**(d.1)** for each month of the calendar quarter, the number of days that effluent was deposited;

**(e)** the total volume of effluent deposited during each month of the reporting quarter as recorded under section 19;

**(f)** the mass loading of the deleterious substances prescribed in section 3 as recorded under section 20; and

**(g)** the results of the effluent characterization conducted under paragraph 15(1)(a).

**(3)** If no effluent is deposited in a calendar quarter, the report shall only include a statement to that effect.

SOR/2006-239, s. 10; SOR/2018-99, ss. 20, 36.

**22** The owner or operator of a mine shall submit to the Minister of the Environment, not later than March 31 in each year, a report in the form set out in Schedule 6, that shall include the following:

**(a)** the identifying information set out in Part 1 of that Schedule;

**(b)** the effluent monitoring results for the previous calendar year, including

**(i)** test results respecting each final discharge point, and

**(ii)** the results of acute lethality tests; and

**(c)** the following information regarding non-compliance:

**(i)** if the results of any effluent monitoring tests indicate that the maximum authorized concentrations set out in Schedule 4 were exceeded or that the pH of the effluent is less than 6.0 or greater than 9.5, the causes of that non-compliance and the remedial measures that are planned or that have been implemented, and

application du paragraphe 12(1) de même que la concentration de ces substances nocives dans les échantillons d'effluent prélevés au titre des paragraphes 13(1) ou (2);

**c)** le pH des échantillons, exigé par le paragraphe 12(1);

**d)** pour chaque échantillon d'effluent prélevé en application du paragraphe 12(1), s'il s'agit d'un échantillon composite ou instantané;

**d.1)** pour chaque mois du trimestre civil, le nombre de jours où il y a eu rejet d'effluent;

**e)** le volume total d'effluent rejeté pour chaque mois du trimestre, enregistré en application de l'article 19;

**f)** la charge des substances nocives désignées à l'article 3 enregistrée en application de l'article 20;

**g)** les résultats des essais de caractérisation de l'effluent effectués conformément à l'alinéa 15(1)a).

**(3)** Si au cours d'un trimestre civil aucun effluent n'a été rejeté, le rapport ne comporte qu'une mention à cet effet.

DORS/2006-239, art. 10; DORS/2018-99, art. 20 et 36.

**22** Le propriétaire ou l'exploitant d'une mine présente au ministre de l'Environnement, au plus tard le 31 mars de chaque année, un rapport en la forme prévue à l'annexe 6 et comportant les renseignements suivants :

**a)** les renseignements identificatoires prévus à la partie 1 de cette annexe;

**b)** les résultats du suivi de l'effluent pour l'année civile précédente dont :

**(i)** les résultats des essais à chacun des points de rejet final,

**(ii)** les résultats des essais de détermination de la létalité aiguë;

**c)** les renseignements suivants sur la non-conformité :

**(i)** si les résultats des essais de suivi de l'effluent montrent que les concentrations maximales permises prévues à l'annexe 4 ont été dépassées ou que le pH de l'effluent est inférieur à 6,0 ou supérieur à 9,5, les causes ainsi que les mesures correctives projetées ou mises en œuvre,

**(ii)** if the results of any acute lethality tests indicate that an effluent sample was determined to be acutely lethal, the remedial measures that are planned or that have been implemented.

SOR/2006-239, s. 11; SOR/2018-99, s. 21.

**23** Any report or information referred to in sections 7, 21 and 22 shall be submitted electronically in the format provided by the Department of the Environment, but the report or information shall be submitted in writing if

**(a)** no such format has been provided; or

**(b)** it is, owing to circumstances beyond the control of either the owner or the operator, impracticable to submit the report or information electronically in the format provided.

SOR/2006-239, s. 11; SOR/2018-99, s. 22.

**24 (1)** The owner or operator of a mine shall notify an inspector without delay if the results of the effluent monitoring tests conducted under section 12 or 13, subsection 14(1) or section 15 or 16 indicate that

**(a)** the limits set out in Schedule 4 are being or have been exceeded;

**(b)** the pH of the effluent is less than 6.0 or greater than 9.5; or

**(c)** an effluent is acutely lethal.

**(2)** The owner or operator shall provide a written report of the test results to the inspector within 30 days after the tests have been completed.

**(3)** [Repealed, SOR/2018-99, s. 23]

SOR/2006-239, s. 12; SOR/2018-99, s. 23.

## Relief

**25 (1)** Any time period specified for collecting samples of effluent referred to in this Division may be extended if

**(a)** unforeseen circumstances cause safety concerns or access problems and render the collection of samples of effluent impracticable; and

**(b)** the owner or operator of a mine notifies an inspector, without delay, of the circumstances and indicates when they expect to be able to collect the samples.

**(ii)** si les résultats des essais de détermination de la létalité aiguë démontrent qu'un échantillon d'effluent présente une létalité aiguë, les mesures correctives projetées ou mises en œuvre.

DORS/2006-239, art. 11; DORS/2018-99, art. 21.

**23** Les rapports et renseignements visés aux articles 7, 21 et 22 sont présentés sous forme électronique selon le modèle fourni par le ministère de l'Environnement. Ils sont toutefois présentés par écrit dans l'un ou l'autre des cas suivants :

**a)** aucun modèle n'est fourni;

**b)** il est pratiquement impossible, pour des raisons indépendantes de la volonté du propriétaire ou de l'exploitant, selon le cas, de les présenter sous forme électronique selon le modèle fourni.

DORS/2006-239, art. 11; DORS/2018-99, art. 22.

**24 (1)** Le propriétaire ou l'exploitant d'une mine avise sans délai l'inspecteur si les résultats des essais de suivi de l'effluent effectués au titre des articles 12 ou 13, du paragraphe 14(1) ou des articles 15 ou 16 montrent que :

**a)** les limites prévues à l'annexe 4 sont ou ont été dépassées;

**b)** le pH de l'effluent est inférieur à 6,0 ou supérieur à 9,5;

**c)** l'effluent est un effluent à létalité aiguë.

**(2)** Il présente à l'inspecteur un rapport écrit des résultats des essais dans les trente jours suivant la fin de ceux-ci.

**(3)** [Abrogé, DORS/2018-99, art. 23]

DORS/2006-239, art. 12; DORS/2018-99, art. 23.

## Dispense

**25 (1)** Les délais prévus dans la présente section à l'égard du prélèvement des échantillons d'effluent peuvent être prorogés si les conditions suivantes sont réunies :

**a)** des circonstances imprévues provoquent des problèmes de sécurité ou d'accessibilité et rendent le prélèvement d'échantillons d'effluent pratiquement impossible;

**b)** le propriétaire ou l'exploitant d'une mine a avisé l'inspecteur sans délai des circonstances et lui a indiqué le moment où il croit pouvoir procéder au prélèvement des échantillons.

**(2)** The owner or operator shall collect the samples of effluent without delay when the circumstances permit.

SOR/2006-239, s. 13.

**(2)** Le propriétaire ou l'exploitant prélève les échantillons d'effluent sans délai dès que les circonstances le permettent.

DORS/2006-239, art. 13.

## DIVISION 3

# Notice, Records and Other Documents

## End of Commercial Operation Notice

**26 (1)** The owner or operator of a mine shall notify the Minister of the Environment in writing of the day on which the mine has stopped commercial operation not later than 90 days after the end of commercial operation.

**(2)** The owner or operator shall notify the Minister of the Environment in writing without delay if the mine returns to commercial operation.

SOR/2018-99, s. 36.

## Records, Books of Account or Other Documents

**27** The owner or operator of a mine shall keep all records, books of account or other documents required by these Regulations at the mine for a period of not less than five years, beginning on the day on which they are made, including

**(a)** records relating to all final discharge points, including any changes to those records;

**(b)** records relating to effluent monitoring equipment, including the calibration of that equipment;

**(c)** records relating to the data referred to in section 9.1 of Reference Method EPS 1/RM/10, section 8.1 of Reference Method EPS 1/RM/13 and section 8.1 of Reference Method EPS 1/RM/14;

**(d)** compensation plans;

**(e)** emergency response plans, including each update to the plan;

**(f)** reports on any unauthorized deposits;

**(g)** reports or other documents prepared and data collected for the purposes of environmental effects monitoring studies; and

## SECTION 3

# Avis, registres et autres documents

## Avis de la fin de l'exploitation commerciale

**26 (1)** Le propriétaire ou l'exploitant d'une mine avise le ministre de l'Environnement par écrit de la date où l'exploitation commerciale de la mine a cessé, dans les quatre-vingt-dix jours suivant la cessation.

**(2)** Il avise le ministre de l'Environnement, par écrit et sans délai, de la reprise de l'exploitation commerciale.

DORS/2018-99, art. 36.

## Registres, livres comptables ou autres documents

**27** Le propriétaire ou l'exploitant d'une mine conserve à la mine, pendant au moins cinq ans à compter de leur établissement, tous les registres, livres comptables ou autres documents exigés par le présent règlement, soit, notamment :

**a)** les registres concernant les points de rejet final et tout changement à ces registres;

**b)** les registres concernant les équipements de surveillance des effluents, y compris les registres de calibration de ces équipements;

**c)** les registres concernant les données visées à la section 9.1 de la méthode de référence SPE 1/RM/10, à la section 8.1 de la méthode de référence SPE 1/RM/13 et à la section 8.1 de la méthode de référence SPE 1/RM/14;

**d)** les plans compensatoires;

**e)** les plans d'intervention d'urgence et chacune de leurs mises à jour;

**f)** tout rapport sur le rejet non autorisé;

**(h)** records and reports of measurements with respect to the pH, temperature and concentration of any deleterious substance prescribed in section 3.

SOR/2018-99, s. 24.

**g)** tous les rapports ou autres documents préparés et toutes les données recueillies pour une étude de suivi des effets sur l'environnement;

**h)** registres et rapports concernant toutes les mesures de pH, de la température et des concentrations des substances nocives énumérées à l'article 3.

DORS/2018-99, art. 24.

**DIVISION 4**

# Tailings Impoundment Areas

## Compensation Plan

**27.1 (1)** The owner or operator of a mine shall, before depositing a deleterious substance into a tailings impoundment area that is set out in Schedule 2, submit to the Minister of the Environment a compensation plan that includes the information described in subsection (2) and obtain that Minister's approval of the plan.

**(2)** The purpose of the compensation plan is to offset the loss of fish habitat resulting from the deposit of any deleterious substance into the tailings impoundment area. It shall contain the following information:

**(a)** a description of the location of the tailings impoundment area and of fish habitat that will be affected by the deposit;

**(b)** a quantitative impact assessment of the deposit on fish habitat;

**(c)** a description of the measures to be taken to offset the loss of fish habitat;

**(d)** a description of the measures to be taken during the planning and implementation of the compensation plan to mitigate any potential adverse effects on fish habitat that could result from the plan's implementation;

**(e)** a description of the measures to be taken to monitor the plan's implementation;

**(f)** a description of the measures to be taken to verify the extent to which the plan's purpose has been achieved;

**(g)** the time required to implement the plan that allows for the achievement of the plan's purpose within a reasonable time; and

**(h)** an estimate of the cost of implementing each element of the plan.

**SECTION 4**

# Dépôts de résidus miniers

## Plan compensatoire

**27.1 (1)** Avant de rejeter des substances nocives dans tout dépôt de résidus miniers qui figure à l'annexe 2, le propriétaire ou l'exploitant d'une mine présente au ministre de l'Environnement un plan compensatoire qui comporte les renseignements énumérés au paragraphe (2) et obtient son approbation.

**(2)** Le plan compensatoire a pour objectif de contrebalancer la perte d'habitat du poisson consécutive au rejet de substances nocives dans le dépôt de résidus miniers. Il comporte les renseignements suivants :

**a)** une description de l'emplacement du dépôt de résidus miniers et de l'habitat du poisson qui sera affecté par le rejet;

**b)** l'analyse quantitative de l'incidence du rejet sur l'habitat du poisson;

**c)** une description des mesures visant à contrebalancer la perte d'habitat du poisson;

**d)** une description des mesures envisagées durant la planification et la mise en œuvre du plan pour atténuer les effets défavorables sur l'habitat du poisson qui pourraient résulter de cette mise en œuvre;

**e)** une description des mesures de surveillance de la mise en œuvre du plan;

**f)** une description des mécanismes permettant de mesurer l'atteinte de l'objectif du plan;

**g)** le délai de la mise en œuvre du plan qui permet l'atteinte de son objectif dans un délai raisonnable;

**h)** l'estimation du coût de mise en œuvre de chacun des éléments du plan.

**(3)** The owner or operator of a mine shall submit with the compensation plan an irrevocable letter of credit to cover the plan's implementation costs, which letter of credit shall be payable upon demand on the declining balance of the implementation costs.

**(4)** The Minister of the Environment shall approve the compensation plan if it meets the requirements of subsection (2) and the owner or operator of a mine has complied with subsection (3).

**(5)** The owner or operator of a mine shall ensure that the compensation plan approved by the Minister of the Environment is implemented and, if the compensation plan's purpose is not being achieved, the owner or operator shall inform the Minister of the Environment.

**(6)** If the compensation plan's purpose is not being achieved, the owner or operator of a mine shall, as soon as practicable in the circumstances, identify and implement all necessary remedial measures to ensure that the purpose is achieved.

SOR/2006-239, s. 14; SOR/2018-99, s. 24.

**(3)** Le propriétaire ou l'exploitant d'une mine présente, avec le plan compensatoire, une lettre de crédit irrévocable couvrant les coûts de mise en œuvre du plan et payable sur demande à l'égard du coût des éléments du plan qui n'ont pas été mis en œuvre.

**(4)** Le ministre de l'Environnement approuve le plan compensatoire si celui-ci satisfait aux exigences visées au paragraphe (2) et si le propriétaire ou l'exploitant de la mine s'est conformé au paragraphe (3).

**(5)** Le propriétaire ou l'exploitant d'une mine veille à ce que le plan compensatoire qui a été approuvé par le ministre de l'Environnement soit mis en œuvre et informe ce dernier si l'objectif du plan n'a pas été atteint.

**(6)** Si l'objectif du plan compensatoire n'est pas atteint, le propriétaire ou l'exploitant d'une mine prend les mesures correctives nécessaires le plus tôt possible, eu égard aux circonstances.

DORS/2006-239, art. 14; DORS/2018-99, art. 24.

### Deposits from Tailings Impoundment Areas

**28 (1)** The owner or operator of a mine shall deposit effluent from a tailings impoundment area only through a final discharge point that is monitored and reported on in accordance with the requirements of these Regulations.

**(2)** The owner or operator of a mine shall comply with section 6 and the conditions prescribed in paragraphs 4(1)(a) to (c) for all effluent that exits a tailing impoundment area.

### Rejets à partir de dépôts de résidus miniers

**28 (1)** Le propriétaire ou l'exploitant d'une mine ne rejette l'effluent provenant d'un dépôt de résidus miniers qu'à un point de rejet final faisant l'objet d'un suivi et de rapports conformément aux exigences du présent règlement.

**(2)** Il remplit les conditions prévues aux alinéas 4(1)a) à c) et se conforme à l'article 6 lorsqu'il rejette un tel effluent.

**PART 3**

## Unauthorized Deposits

**29** [Repealed, SOR/2018-99, s. 25]

### Emergency Response Plan

**30 (1)** The owner or operator of a mine shall prepare an emergency response plan that describes the measures to be taken in respect of a deleterious substance within the meaning of subsection 34(1) of the Act to prevent any unauthorized deposit of such a substance or to mitigate the effects of such a deposit.

**PARTIE 3**

## Rejets non autorisés

**29** [Abrogé, DORS/2018-99, art. 25]

### Plan d'intervention d'urgence

**30 (1)** Le propriétaire ou l'exploitant d'une mine dresse un plan d'intervention d'urgence qui énonce, à l'égard d'une substance nocive au sens du paragraphe 34(1) de la Loi, les mesures à prendre pour prévenir tout rejet non autorisé d'une telle substance ou pour en atténuer les effets.

**(2)** The emergency response plan shall include the following elements:

**(a)** the identification of any unauthorized deposit that can reasonably be expected to occur at the mine and that can reasonably be expected to result in damage or danger to fish habitat or fish or the use by man of fish, and the identification of the damage or danger;

**(b)** a description of the measures to be used to prevent, prepare for, respond to and recover from a deposit identified under paragraph (a);

**(c)** a list of the individuals who are to implement the plan in the event of an unauthorized deposit, and a description of their roles and responsibilities;

**(d)** the identification of the emergency response training required for each of the individuals listed under paragraph (c);

**(e)** a list of the emergency response equipment included as part of the plan, and the equipment's location; and

**(f)** alerting and notification procedures including the measures to be taken to notify members of the public who may be adversely affected by a deposit identified under paragraph (a).

**(3)** The owner or operator shall complete the emergency response plan and have it available for inspection no later than 60 days after the mine becomes subject to this section.

**(4)** The owner or operator shall update and test the emergency response plan at least once each year to ensure that the plan continues to meet the requirements of subsection (2).

**(4.1)** The owner or operator of a mine shall, each time the emergency response plan is tested, record the following information and keep the record for at least five years:

**(a)** a summary of the test;

**(b)** the test results; and

**(c)** any modifications that are made to the plan as a consequence of the test.

**(4.2)** The owner or operator of a mine shall ensure that a copy of the most recent version of the emergency response plan is kept at the mine in a location that is readily available to the individuals who are responsible for implementing the plan.

**(2)** Le plan d'intervention d'urgence comporte en outre les éléments suivants :

**a)** la mention de tout rejet non autorisé qui pourrait se produire à la mine et entraîner des dommages ou des risques réels de dommages pour le poisson ou son habitat ou pour l'utilisation par l'homme du poisson, ainsi que l'identification de ces risques ou dommages;

**b)** le détail des mesures de prévention, de préparation, d'intervention et de réparation applicable à l'égard du rejet non autorisé mentionné au titre de l'alinéa a);

**c)** la liste des personnes chargées de mettre à exécution le plan en cas de rejet non autorisé ainsi qu'une description de leurs rôles et responsabilités;

**d)** la mention de la formation en intervention d'urgence exigée des personnes visées à l'alinéa c);

**e)** la liste de l'équipement d'intervention d'urgence prévu dans le plan et l'emplacement de cet équipement;

**f)** les procédures d'alerte et de notification, notamment les mesures prévues pour avertir les membres du public auxquels le rejet irrégulier mentionné au titre de l'alinéa a) pourrait causer un préjudice.

**(3)** Le propriétaire ou l'exploitant termine le plan d'intervention d'urgence, lequel doit être disponible pour inspection, dans les soixante jours suivant la date à laquelle la mine devient assujettie au présent article.

**(4)** Il tient à jour et met à l'essai le plan d'intervention d'urgence au moins une fois par année afin de veiller à ce que celui-ci satisfasse aux exigences du paragraphe (2).

**(4.1)** Chaque fois que le plan d'intervention est mis à l'essai, le propriétaire ou l'exploitant d'une mine consigne dans un registre les renseignements ci-après qu'il conserve pendant au moins cinq ans :

**a)** un résumé de l'essai;

**b)** les résultats de cet essai;

**c)** les modifications apportées au plan à la suite de cet essai.

**(4.2)** Il veille à ce qu'une copie du plan d'intervention d'urgence à jour soit conservée à la mine, à un endroit facilement accessible aux personnes chargées de mettre à exécution le plan.

**(5)** If a mine has not been subject to the requirements of this section for more than one year, a new emergency response plan shall be prepared and completed no later than 60 days after the day on which the mine again becomes subject to this section.

SOR/2006-239, s. 16; SOR/2012-22, s. 6(F); SOR/2018-99, s. 26.

## Reporting

**31** A report required by subsection 38(7) of the Act in respect of the unauthorized deposit of a deleterious substance shall contain the following information:

**(a)** the name, description and concentration of the deleterious substance deposited;

**(b)** the estimated quantity of the deposit and how the estimate was achieved;

**(c)** the day on which, and hour at which, the deposit occurred;

**(d)** the quantity of the deleterious substance that was deposited at a place other than through a final discharge point and the identification of that place, including the location by latitude and longitude and, if applicable, the civic address;

**(e)** the quantity of the deleterious substance that was deposited through a final discharge point and the identification of that discharge point;

**(f)** the name of the receiving body of water, if there is a name, and the location by latitude and longitude where the deleterious substance entered the receiving body of water;

**(g)** the results of the acute lethality tests conducted under subsection 31.1(1) or a statement indicating that acute lethality tests were not conducted but that notification was given under subsection 31.1(2);

**(h)** the circumstances of the deposit, the measures that were taken to mitigate the effects of the deposit and, if the emergency response plan was implemented, details concerning its implementation; and

**(i)** the measures that were taken, or that are intended to be taken, to prevent any similar occurrence of an unauthorized deposit.

SOR/2006-239, s. 17; SOR/2011-92, s. 6; SOR/2018-99, s. 27.

**(5)** Si la mine n'a pas été assujettie au présent article pendant plus d'un an, un nouveau plan d'intervention d'urgence est dressé — et doit être terminé — dans les soixante jours suivant la date à laquelle elle le redevient.

DORS/2006-239, art. 16; DORS/2012-22, art. 6(F); DORS/2018-99, art. 26.

## Rapport

**31** Le rapport exigé au paragraphe 38(7) de la Loi, à l'égard du rejet non autorisé d'une substance nocive, comporte les renseignements suivants :

**a)** le nom, la description et la concentration de la substance nocive rejetée;

**b)** la quantité estimative du rejet ainsi que la méthode d'estimation utilisée;

**c)** la date et l'heure du rejet;

**d)** la quantité de la substance nocive qui a été rejetée à partir d'un lieu autre qu'un point de rejet final et la mention de ce lieu ainsi que sa latitude et sa longitude et, le cas échéant, l'adresse municipale;

**e)** la quantité de la substance nocive qui a été rejetée à partir d'un point de rejet final, et la mention de celui-ci;

**f)** le nom du milieu aquatique récepteur, si ce nom existe, et la latitude et la longitude du point de pénétration de la substance nocive dans le milieu aquatique;

**g)** les résultats des essais de détermination de la létalité aiguë effectués en application du paragraphe 31.1(1) ou une attestation indiquant qu'aucun essai de détermination de la létalité aiguë n'a été effectué mais que l'avis visé au paragraphe 31.1(2) a été donné;

**h)** les circonstances du rejet, les mesures d'atténuation prises et, le cas échéant, le détail de l'exécution du plan d'intervention d'urgence;

**i)** les mesures prises ou planifiées afin d'éviter d'autres rejets semblables à l'avenir.

DORS/2006-239, art. 17; DORS/2011-92, art. 6; DORS/2018-99, art. 27.

## Acute Lethality Testing

**31.1 (1)** If an unauthorized deposit of a deleterious substance occurs, the owner or operator of a mine shall, without delay, collect a grab sample of effluent at the place where the deposit occurred and determine whether the effluent is acutely lethal by conducting tests on aliquots of each effluent sample in accordance with sections 14.1 and 14.2.

**(2)** Despite subsection (1), the owner or operator of a mine is not required to conduct those tests if they notify an inspector, without delay, that the deposit is an acutely lethal effluent.

SOR/2018-99, s. 27.

## Essai de détermination de la létalité aiguë

**31.1 (1)** En cas de rejet non autorisé d'une substance nocive, le propriétaire ou l'exploitant d'une mine prélève sans délai un échantillon instantané d'effluent sur les lieux du rejet non autorisé et détermine si cet effluent présente une létalité aiguë en effectuant des essais conformément aux articles 14.1 et 14.2 sur des portions aliquotes de chaque échantillon d'effluent prélevé.

**(2)** Malgré le paragraphe (1), le propriétaire ou l'exploitant d'une mine n'est pas tenu d'effectuer les essais s'il avise sans délai l'inspecteur que le rejet est un effluent à létalité aiguë.

DORS/2018-99, art. 27.

**PART 4**

# Recognized Closed Mines

## Requirements

**32 (1)** An owner or operator who intends to close a mine shall

**(a)** provide written notice of that intention to the Minister of the Environment;

**(b)** maintain the mine's rate of production at less than 10% of its design-rated capacity for a continuous period of three years starting on the day on which the written notice is received by the Minister of the Environment; and

**(c)** conduct a biological monitoring study during the three-year period referred to in paragraph (b) in accordance with Division 3 of Part 2 of Schedule 5.

**(2)** If the owner or operator has complied with all of the requirements set out in paragraphs (1)(a) to (c), the mine becomes a recognized closed mine after the expiry of the three-year period referred to in subsection (1).

**(3)** The owner or operator shall notify the Minister of the Environment in writing at least 60 days before reopening the recognized closed mine.

**(4)** The owner or operator referred to in this section shall keep at any place in Canada all records, books of account or other documents required by these Regulations for a period of not less than five years beginning on the day

**PARTIE 4**

# Mines fermées reconnues

## Exigences

**32 (1)** Le propriétaire ou l'exploitant qui souhaite fermer sa mine :

**a)** en avise le ministre de l'Environnement par écrit;

**b)** maintient le taux de production de la mine à moins de 10 % de sa capacité nominale durant une période continue de trois ans commençant à la date à laquelle le ministre de l'Environnement reçoit l'avis;

**c)** effectue, durant la période prévue à l'alinéa b), une étude de suivi biologique conformément à la section 3 de la partie 2 de l'annexe 5.

**(2)** La mine devient une mine fermée reconnue à l'expiration de la période de trois ans prévue au paragraphe (1) si le propriétaire ou l'exploitant s'est conformé aux exigences visées aux alinéas (1)a) à c).

**(3)** Le propriétaire ou l'exploitant avise par écrit le ministre de l'Environnement de la réouverture de la mine fermée reconnue au moins soixante jours avant la réouverture.

**(4)** Le propriétaire ou l'exploitant visé par le présent article conserve n'importe où au Canada tous les registres, livres comptables ou autres documents exigés par le présent règlement pendant au moins cinq ans à compter de

they are made, and shall notify the Minister of the Environment in writing of their location.

SOR/2006-239, s. 18; SOR/2018-99, ss. 28, 36.

## Identifying Information

**33 (1)** The owner or operator of a recognized closed mine shall submit in writing to the Minister of the Environment the information referred to in subsection (2) not later than 60 days after the day on which

**(a)** the recognized closed mine becomes subject to these Regulations; or

**(b)** ownership of the recognized closed mine is transferred.

**(2)** The information that shall be submitted is the name and address of

**(a)** both the owner and the operator of the recognized closed mine; and

**(b)** any parent company of the owner or the operator.

**(3)** The owner or operator shall notify the Minister of the Environment of any change in the information not later than 60 days after the change occurs.

SOR/2018-99, s. 36.

**34** [Repealed, SOR/2018-99, s. 29]

**35** [Repealed, SOR/2018-99, s. 29]

**36** [Repealed, SOR/2018-99, s. 29]

**37** [Repealed, SOR/2018-99, s. 29]

**38** [Repealed, SOR/2018-99, s. 29]

**39** [Repealed, SOR/2018-99, s. 29]

**40** [Repealed, SOR/2018-99, s. 29]

**41** [Repealed, SOR/2018-99, s. 29]

**42** [Repealed, SOR/2018-99, s. 29]

leur établissement et avise le ministre de l'Environnement par écrit du lieu où ils se trouvent.

DORS/2006-239, art. 18; DORS/2018-99, art. 28 et 36.

## Renseignements d'identification

**33 (1)** Le propriétaire ou l'exploitant d'une mine fermée reconnue présente par écrit au ministre de l'Environnement les renseignements mentionnés au paragraphe (2) :

**a)** dans les soixante jours suivant la date à laquelle la mine fermée reconnue devient assujettie au présent règlement;

**b)** dans les soixante jours suivant le transfert de propriété de la mine fermée reconnue.

**(2)** Les renseignements à présenter sont :

**a)** les nom et adresse du propriétaire et de l'exploitant;

**b)** les nom et adresse de toute société mère du propriétaire ou de l'exploitant.

**(3)** Le propriétaire ou l'exploitant avise le ministre de l'Environnement de tout changement des renseignements dans les soixante jours suivant le changement.

DORS/2018-99, art. 36.

**34** [Abrogé, DORS/2018-99, art. 29]

**35** [Abrogé, DORS/2018-99, art. 29]

**36** [Abrogé, DORS/2018-99, art. 29]

**37** [Abrogé, DORS/2018-99, art. 29]

**38** [Abrogé, DORS/2018-99, art. 29]

**39** [Abrogé, DORS/2018-99, art. 29]

**40** [Abrogé, DORS/2018-99, art. 29]

**41** [Abrogé, DORS/2018-99, art. 29]

**42** [Abrogé, DORS/2018-99, art. 29]

## SCHEDULE 1

[Repealed, SOR/2018-99, s. 30]

## ANNEXE 1

[Abrogée, DORS/2018-99, art. 30]

## SCHEDULE 2

(Subsections 5(1) and 27.1(1))

# Tailings Impoundment Areas

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 1 | Anderson Lake, Manitoba | Anderson Lake located at 54°51′ north latitude and 100°0′ west longitude near the town of Snow Lake, Manitoba. More precisely, the area bounded by<br>**(a)** the contour of elevation around Anderson Lake at the 285-m level, and<br>**(b)** the control dam built at the east end of Anderson Lake. |
| 2 | Garrow Lake, Nunavut | Garrow Lake located at 75°23′ north latitude and 97°48′ west longitude near the south end of Little Cornwallis Island, Nunavut. |
| 3 | South Kemess Creek, British Columbia | That part of South Kemess Creek being within the watershed of that tributary of South Kemess Creek<br>**(a)** extending eastwards and upstream from the centre of a tailings dam constructed at 57°1′ north latitude and 126°41′ west longitude, and<br>**(b)** below the crest of the dam at an elevation of 1515 m. |
| 4 | Albino Lake, British Columbia | Albino Lake located at 56°39.4′ north latitude and 130°29.4′ west longitude near the Eskay Creek Mine in British Columbia. More precisely, the area bounded by<br>**(a)** the contour of elevation around Albino Lake at the 1040-m level, and<br>**(b)** the outlet of Albino Lake. |
| 5 | Tom MacKay Lake, British Columbia | Tom MacKay Lake located at 56°39′ north latitude and 130°34′ west longitude near the Eskay Creek Mine in British Columbia. More precisely, the area bounded by<br>**(a)** the contour of elevation around Tom MacKay Lake at the 1078-m level, and<br>**(b)** the outlet of Tom MacKay Lake. |
| 6 | Trout Pond, Newfoundland and Labrador | Trout Pond located at 48°39′0.81882″ north latitude and 56°29′19.704984″ west longitude in west-central Newfoundland. More precisely, the area bounded by<br>**(a)** the contour of elevation around Trout Pond at the 270 m level, and<br>**(b)** the outlet of Trout Pond. |
| 7 | The headwater pond of a tributary to Gill's Pond Brook, Newfoundland and Labrador | The headwater pond of a tributary to Gill's Pond Brook, located at 48°38′29.599584″ north latitude and 56°30′15.560676″ west longitude in west-central Newfoundland. More precisely, the area bounded by<br>**(a)** the contour of elevation around the pond at the 260 m level, and<br>**(b)** the outlet of the pond. |

## ANNEXE 2

(paragraphes 5(1) et 27.1(1))

# Dépôts de résidus miniers

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 1 | Lac Anderson, Manitoba | Le lac Anderson, situé par 54°51′ de latitude N. et 100°0′ de longitude O., près de la ville de Snow Lake, au Manitoba. Plus précisément, le lieu délimité par :<br>**a)** la courbe de niveau à 285 m autour du lac Anderson;<br>**b)** le barrage de régulation à l'extrémité est du lac Anderson. |
| 2 | Lac Garrow, Nunavut | Le lac Garrow, situé par 75°23′ de latitude N. et 97°48′ de longitude O., près de l'extrémité sud de la petite île Cornwallis, au Nunavut. |
| 3 | Ruisseau South Kemess, Colombie-Britannique | La partie du ruisseau South Kemess située dans le bassin hydrographique du tributaire du ruisseau South Kemess :<br>**a)** qui s'étend vers l'est et en amont du centre d'un barrage de retenue des stériles situé par 57°1′ de latitude N. et 126°41′ de longitude O.;<br>**b)** qui se trouve en dessous de la crête du barrage, à une altitude de 1515 m. |
| 4 | Lac Albino, Colombie-Britannique | Le lac Albino, situé par 56°39,4′ de latitude N. et 130°29,4′ de longitude O., près de la mine Eskay Creek, en Colombie-Britannique. Plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 1040 m autour du lac Albino;<br>**b)** la décharge du lac Albino. |
| 5 | Lac Tom MacKay, Colombie-Britannique | Le lac Tom MacKay, situé par 56°39′ de latitude N. et 130°34′ de longitude O., près de la mine Eskay Creek, en Colombie-Britannique. Plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 1078 m autour du lac Tom MacKay;<br>**b)** la décharge du lac Tom Mackay. |
| 6 | Trout Pond, Terre-Neuve-et-Labrador | L'étang Trout Pond, situé par 48°39′0,818 82″ de latitude N. et 56°29′19,704 984″ de longitude O., dans la partie centrale ouest de Terre-Neuve et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 270 m autour de l'étang Trout Pond;<br>**b)** la décharge de l'étang Trout Pond. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 8 | The northwest arm of Second Portage Lake, Nunavut | That portion of the northwest arm of Second Portage Lake, located at 65°1′39.29″ north latitude and 96°3′43″ west longitude, approximately 80 km north of the town of Baker Lake, Nunavut. More precisely, the area bounded by<br>**(a)** the contour of elevation around the arm at the 146 m level, and<br>**(b)** the dam built at the southeast end of the arm. |
| 9 | Tail Lake, Nunavut | Tail Lake, located at 68°7′25.8″ north latitude and 106°33′31.2″ west longitude, approximately 125 km southwest of the town of Cambridge Bay, Nunavut. More precisely, the area bounded by<br>**(a)** the contour of elevation around Tail Lake at the 33.5 m level, and<br>**(b)** the dams built at the south and north ends of the lake. |
| 10 | A portion of Wabush Lake, Newfoundland and Labrador | That portion of Wabush Lake near the towns of Labrador City and Wabush in western Labrador. More precisely, the area bounded by<br>**(a)** the southern limit, extending from 53° north latitude, 66°50′24″ west longitude to 53° north latitude, 66°52′57″ west longitude, and<br>**(b)** the outlet of Wabush Lake, extending from 53°09′4.7″ north latitude, 66°47′3.5″ west longitude to 53°08′57.5″ north latitude, 66°47′2.9″ west longitude. |
| 11 | Flora Lake, Newfoundland and Labrador | Flora Lake located at 52°55′ north latitude, 66°49′ west longitude, near the towns of Labrador City and Wabush in western Labrador. |
| 12 | A portion of an unnamed tributary stream to Flora Lake, Newfoundland and Labrador | A portion of an unnamed tributary stream to Flora Lake, Newfoundland and Labrador. More precisely, an area extending from the mouth of the stream (52°52′9.94″ north latitude, 66°47′14.26″ west longitude) for a distance of 75 m upstream from Flora Lake. |
| 13 | A portion of an unnamed tributary stream to Flora Lake, Newfoundland and Labrador | A portion of an unnamed tributary stream to Flora Lake, Newfoundland and Labrador. More precisely, an area extending from the mouth of the stream (52°52′10.70″ north latitude, 66°47′6.49″ west longitude) for a distance of 580 m upstream from Flora Lake. |
| 14 | A portion of an unnamed tributary stream to Flora Lake, Newfoundland and Labrador | A portion of an unnamed tributary stream to Flora Lake, Newfoundland and Labrador. More precisely, an area extending from the mouth of the stream (52°52′57.45″ north latitude, 66°47′25.23″ west longitude) for a distance of 256 m upstream from Flora Lake. |

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 7 | L'étang d'amont d'un tributaire du ruisseau Gill, Terre-Neuve-et-Labrador | L'étang d'amont d'un tributaire du ruisseau Gill, situé par 48°38′29,599 584″ de latitude N. et 56°30′15,560 676″ de longitude O., dans la partie centrale ouest de Terre-Neuve et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 260 m autour de l'étang;<br>**b)** la décharge de l'étang. |
| 8 | Le nord-ouest du bras du lac Second Portage, Nunavut | La partie du nord-ouest du bras du lac Second Portage, située par 65°1′39,29″ de latitude N. et 96°3′43″ de longitude O., à environ 80 km au nord de la ville de Baker Lake, au Nunavut et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 146 m autour du bras;<br>**b)** la digue construite à l'extrémité sud-est du bras. |
| 9 | Lac Tail, Nunavut | Le lac Tail, situé par 68°7′25,8″ de latitude N. et 106°33′31,2″ de longitude O., à environ 125 km au sud-ouest de la ville de Cambridge Bay, au Nunavut et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 33,5 m autour du lac;<br>**b)** les digues construites aux extrémités sud et nord du lac. |
| 10 | Une partie du lac Wabush, Terre-Neuve-et-Labrador | La partie du lac Wabush, située près des villes de Labrador City et de Wabush dans la partie ouest du Labrador, et, plus précisément, la région délimitée par :<br>**a)** la limite sud s'étendant de 53° de latitude N. et 66°50′24″ de longitude O., à 53° de latitude N. et 66°52′57″ de longitude O.;<br>**b)** la décharge du lac Wabush, s'étendant de 53°09′4,7″ de latitude N. et 66°47′3,5″ de longitude O., à 53°08′57,5″ de latitude N. et 66°47′2,9″ de longitude O. |
| 11 | Lac Flora, Terre-Neuve-et-Labrador | Le lac Flora, situé par 52°55′ de latitude N. et 66°49′ de longitude O., près des villes de Labrador City et de Wabush dans la partie ouest du Labrador. |
| 12 | Une partie d'un ruisseau sans nom tributaire du lac Flora, Terre-Neuve-et-Labrador | La partie d'un ruisseau sans nom tributaire du lac Flora, Terre-Neuve-et-Labrador, et, plus précisément, la région s'étendant de l'embouchure du ruisseau (52°52′9,94″ de latitude N., 66°47′14,26″ de longitude O.) sur une distance de 75 m en amont du lac Flora. |
| 13 | Une partie d'un ruisseau sans nom tributaire du lac Flora, Terre-Neuve-et-Labrador | La partie d'un ruisseau sans nom tributaire du lac Flora, Terre-Neuve-et-Labrador, et, plus précisément, la région s'étendant de l'embouchure du ruisseau (52°52′10,70″ de latitude N., 66°47′6,49″ de longitude O.) sur une distance de 580 m en amont du lac Flora. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 15 | Sandy Pond, Newfoundland and Labrador | Sandy Pond, located at 47°25′33″ north latitude and 53°46′52″ west longitude, on the Avalon Peninsula, approximately 3 km east southeast of the town of Long Harbour-Mount Arlington Heights, Newfoundland and Labrador. More precisely, the area bounded by<br>**(a)** the contour of elevation around Sandy Pond at the 137 m level, and<br>**(b)** the dams built at the north end of Sandy Pond. |
| 16 | A portion of King Richard Creek, British Columbia | A portion of King Richard Creek, located approximately 60 km southwest of the town of Mackenzie, British Columbia. More precisely, a 3.3 km portion of the creek extending northwards and upstream from the centre of a dam constructed at 55°06′42″ north latitude and 123°59′29″ west longitude, to the centre of a dam constructed at 55°07′52″ north latitude and 124°00′50″ west longitude. |
| 17 | A portion of an unnamed tributary to Alpine Lake, British Columbia | A portion of an unnamed tributary to Alpine Lake, located approximately 60 km southwest of the town of Mackenzie, British Columbia. More precisely, a 900 m portion of the tributary extending southwards and upstream from the centre of a dam constructed at 55°08′19″ north latitude and 124°00′27″ west longitude, to the centre of a dam constructed at 55°07′59″ north latitude and 124°01′00″ west longitude. |
| 18 | A portion of an unnamed tributary to Alpine Lake, British Columbia | A portion of an unnamed tributary to Alpine Lake, located approximately 60 km southwest of the town of Mackenzie, British Columbia. More precisely, a 590 m portion of the tributary extending southwards and upstream from the centre of a dam constructed at 55°08′18″ north latitude and 124°00′41″ west longitude, to the centre of a dam constructed at 55°08′09″ north latitude and 124°01′08″ west longitude. |
| 19 | Mallard Lake, Saskatchewan | Mallard Lake, located at 56°00′32″ north latitude and 104°16′38″ west longitude, approximately 120 km northeast of the town of La Ronge, Saskatchewan. More precisely, the area bounded by<br>**(a)** the contour of elevation around Mallard Lake at the 490 m level, and<br>**(b)** the dam built at the south end of Mallard Lake. |
| 20 | The unnamed headwater pond of an unnamed tributary of East Creek, Ontario | An unnamed headwater pond of an unnamed tributary of East Creek, located at 50°02′17″ north latitude and 79°40′57″ west longitude, approximately 145 km northeast of the town of Cochrane, Ontario. |

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 14 | Une partie d'un ruisseau sans nom tributaire du lac Flora, Terre-Neuve-et-Labrador | La partie d'un ruisseau sans nom tributaire du lac Flora, Terre-Neuve-et-Labrador, et, plus précisément, la région s'étendant de l'embouchure du ruisseau (52°52′57,45″ de latitude N., 66°47′25,23″ de longitude O.) sur une distance de 256 m en amont du lac Flora. |
| 15 | Sandy Pond, Terre-Neuve-et-Labrador | L'étang Sandy Pond, situé par 47°25′33″ de latitude N. et 53°46′52″ de longitude O., dans la péninsule Avalon, à environ 3 km est-sud-est de la ville de Long Harbour-Mount Arlington Heights, Terre-Neuve-et-Labrador, et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 137 m autour de l'étang Sandy Pond;<br>**b)** les digues construites à l'extrémité nord de l'étang Sandy Pond. |
| 16 | Une partie du ruisseau King Richard, Colombie-Britannique | La partie du ruisseau King Richard située à environ 60 km au sud-ouest de la ville de Mackenzie en Colombie-Britannique, et, plus précisément, la partie du ruisseau qui s'étend sur 3,3 km vers le nord et en amont du centre du barrage situé par 55°06′42″ de latitude N. et 123°59′29″ de longitude O. jusqu'au centre du barrage situé par 55°07′52″ de latitude N. et 124°00′50″ de longitude O. |
| 17 | Une partie d'un affluent sans nom tributaire du lac Alpine, Colombie-Britannique | La partie d'un affluent sans nom tributaire du lac Alpine située à environ 60 km au sud-ouest de la ville de Mackenzie en Colombie-Britannique, et, plus précisément, la partie de l'affluent qui s'étend sur 900 m vers le sud et en amont du centre du barrage situé par 55°08′19″ de latitude N. et 124°00′27″ de longitude O. jusqu'au centre du barrage situé par 55°07′59″ de latitude N. et 124°01′00″ de longitude O. |
| 18 | Une partie d'un affluent sans nom tributaire du lac Alpine, Colombie-Britannique | La partie d'un affluent sans nom tributaire du lac Alpine située à environ 60 km au sud-ouest de la ville de Mackenzie en Colombie-Britannique, et, plus précisément, la partie de l'affluent qui s'étend sur 590 m vers le sud et en amont du centre du barrage situé par 55°08′18″ de latitude N. et 124°00′41″ de longitude O. jusqu'au centre du barrage situé par 55°08′09″ de latitude N. et 124°01′08″ de longitude O. |
| 19 | Lac Mallard, Saskatchewan | Le lac Mallard, situé par 56°00′32″ de latitude N. et 104°16′38″ de longitude O., à environ 120 km au nord-est de la ville de La Ronge en Saskatchewan et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 490 m autour du lac Mallard;<br>**b)** le barrage construit à l'extrémité sud du lac Mallard. |
| 20 | L'étang d'amont sans nom d'un tributaire sans nom du ruisseau East, Ontario | L'étang d'amont sans nom d'un tributaire sans nom du ruisseau East situé par 50°02′17″ de latitude N. et 79°40′57″ de longitude O., à environ 145 km au nord-est de la ville de Cochrane, en Ontario. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 21 | A portion of an unnamed tributary to East Creek, Ontario | A portion of an unnamed tributary to East Creek, Ontario, located approximately 145 km northeast of the town of Cochrane, Ontario. More precisely, a 2.3-km portion of the tributary extending northwards and downstream from the outlet of the unnamed headwater pond referred to in item 20, to the centre of a dam constructed at 50°02′43″ north latitude and 79°40′20″ west longitude. |
| 22 | A portion of an unnamed tributary to Linden Creek, Ontario | A portion of an unnamed tributary to Linden Creek, Ontario, located approximately 145 km northeast of the town of Cochrane, Ontario. More precisely, a 1.8-km portion of the tributary extending southwards and downstream from the northern perimeter of a waste rock disposal area at 50°00′17″ north latitude and 79°43′37″ west longitude to the southern perimeter of the waste rock disposal area at 49°59′30″ north latitude and 79°43′07″ west longitude. |
| 23 | A portion of an unnamed tributary to an unnamed lake in the Linden Creek watershed, Ontario | A portion of an unnamed tributary to an unnamed lake in the Linden Creek watershed, Ontario, located approximately 145 km northeast of the town of Cochrane, Ontario. More precisely, a 1.4-km portion of the tributary extending southwards and downstream from the headwaters of the tributary at 50°00′17″ north latitude and 79°42′39″ west longitude to the southern perimeter of a waste rock disposal area at 49°59′25″ north latitude and 79°42′27″ west longitude. |
| 24 | A portion of Trail Creek, British Columbia | A portion of Trail Creek, located approximately 20 km southeast of the community of Iskut, British Columbia. More precisely, a 0.6 km portion of the creek extending southwards and downstream from a natural barrier located at 57°42′59″ north latitude and 129°44′10″ west longitude, to the centre of a dam constructed at 57°42′43″ north latitude and 129°44′20″ west longitude. |
| 25 | Lake Hesse, Quebec | Lake Hesse, located at 52°46′21″ north latitude and 67°20′58″ west longitude, approximately 15 km west of the town of Fermont, Quebec. More precisely, the area bounded by<br>**(a)** the contour of elevation around Lake Hesse at the 620 m level,<br>**(b)** the dam built at the north end of Lake Hesse, and<br>**(c)** the control dam built at the south end of Lake Hesse. |

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 21 | Une partie d'un tributaire sans nom du ruisseau East, Ontario | La partie d'un tributaire sans nom du ruisseau East située à environ 145 km au nord-est de la ville de Cochrane, en Ontario et, plus précisément, la partie du tributaire qui s'étend sur 2,3 km vers le nord et en aval de la décharge de l'étang d'amont sans nom visé à l'article 20 de la présente annexe, jusqu'au centre du barrage situé par 50°02′43″ de latitude N. et 79°40′20″ de longitude O. |
| 22 | Une partie d'un tributaire sans nom du ruisseau Linden, Ontario | La partie d'un tributaire sans nom du ruisseau Linden situé à environ 145 km au nord-est de la ville de Cochrane, en Ontario et, plus précisément, la partie du tributaire qui s'étend sur 1,8 km vers le sud et en aval du périmètre nord d'une aire de décharge de stériles située par 50°00′17″ de latitude N. et 79°43′37″ de longitude O., jusqu'au périmètre sud de l'aire de décharge de stériles située par 49°59′30″ de latitude N. et 79°43′07″ de longitude O. |
| 23 | Une partie d'un tributaire sans nom d'un lac sans nom du bassin hydrographique du ruisseau Linden, Ontario | La partie d'un tributaire sans nom d'un lac sans nom du bassin hydrographique du ruisseau Linden située à environ 145 km au nord-est de la ville de Cochrane, en Ontario et, plus précisément, la partie du tributaire qui s'étend sur 1,4 km vers le sud et en aval des eaux d'amont du tributaire située par 50°00′17″ de latitude N. et 79°42′39″ de longitude O., jusqu'au périmètre sud d'une aire de décharge de stériles située par 49°59′25″ de latitude N. et 79°42′27″ de longitude O. |
| 24 | Une partie du ruisseau Trail, Colombie-Britannique | Une partie du ruisseau Trail situé en Colombie-Britannique à environ 20 km au sud-est de la communauté d'Iskut et, plus précisément, la partie du ruisseau qui s'étend sur 0,6 km vers le sud et en aval de la barrière naturelle située par 57°42′59″ de latitude N. et 129°44′10″ de longitude O. jusqu'au centre du barrage situé par 57°42′43″ de latitude N. et 129°44′20″ de longitude O. |
| 25 | Le lac Hesse, Québec | Le lac Hesse, situé par 52°46′21″ de latitude N. et 67°20′58″ de longitude O., à environ 15 km à l'ouest de la ville de Fermont, au Québec, et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 620 m autour du lac Hesse;<br>**b)** le barrage construit à l'extrémité nord du lac Hesse;<br>**c)** le barrage de régulation construit à l'extrémité sud du lac Hesse. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 26 | An unnamed lake approximately 20 km west of Fermont, Quebec and a portion of its outlet | An unnamed lake, located at 52°49′43″ north latitude and 67°22′23″ west longitude, approximately 20 km west of the town of Fermont, Quebec, and a portion of its outlet. More precisely, the area bounded by<br>**(a)** the contour of elevation around the lake at the 660 m level, and<br>**(b)** the outlet of the lake extending from the mouth of an outlet stream at 52°49′33″ north latitude and 67°22′18″ west longitude for a distance of 30 m downstream from that mouth. |
| 27 | A portion of an unnamed stream discharging waters from an unnamed lake, other than the one referred to in item 26, approximately 20 km west of Fermont, Quebec | A portion of an unnamed stream discharging waters from an unnamed lake, other than the one referred to in item 26, approximately 20 km west of the town of Fermont, Quebec. More precisely, the 1815 m portion of the stream that extends southwards and downstream from the point located at 52°50′02″ north latitude and 67°21′29″ west longitude to the point located at 52°49′20″ north latitude and 67°21′39″ west longitude. |
| 28 | A portion of South Teigen Creek, British Columbia | A portion of South Teigen Creek, located approximately 65 km northwest of Stewart, British Columbia. More precisely, an 8.1-km portion of the creek extending northwestwards and downstream from the point located at 56°37′53″ north latitude and 129°54′44″ west longitude to the centre of a dam located at 56°40′11.57″ north latitude and 129°58′20.92″ west longitude. |
| 29 | A portion of North Treaty Creek, British Columbia | A portion of North Treaty Creek, located approximately 65 km northwest of Stewart, British Columbia. More precisely, a 3.3-km portion of the creek extending southwards and downstream from the headwaters of the creek located at 56°37′34″ north latitude and 129°54′50″ west longitude to the centre of a dam located at 56°35′54.24″ north latitude and 129°51′25.31″ west longitude. |
| 30 | An unnamed watercourse that is a tributary to Lake Jean, located approximately 25 km southeast of Chibougamau, Quebec | The unnamed watercourse that is a tributary to Lake Jean, located approximately 25 km southeast of the town of Chibougamau, Quebec, beginning at the unnamed pond located at 49°47′58″ north latitude and 74°01′38″ west longitude and extending northwards and downstream for a distance of 6.4 km to the centre of the dam constructed at 49°49′29″ north latitude and 74°03′07″ west longitude. |
| 31 | A portion of an unnamed watercourse that is a tributary to the watercourse referred to in item 30 | A portion of an unnamed watercourse beginning at that watercourse's point of confluence with the watercourse referred to in item 30, which confluence is located at 49°47′57″ north latitude and 74°03′25″ west longitude, and extending for a distance of 1 km northwards and upstream from that point. |

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 26 | Un lac sans nom situé à environ 20 km à l'ouest de Fermont, Québec et une partie de sa décharge | Un lac sans nom, situé par 52°49′43″ de latitude N. et 67°22′23″ de longitude O., à environ 20 km à l'ouest de la ville de Fermont, au Québec, et une partie de sa décharge, et, plus précisément, la région délimitée par :<br>**a)** la courbe de niveau à 660 m autour du lac;<br>**b)** la décharge du lac s'étendant de l'embouchure de l'émissaire situé par 52°49′33″ de latitude N. et 67°22′18″ de longitude O., sur une distance de 30 m en aval de son embouchure. |
| 27 | Une partie d'un ruisseau sans nom évacuant les eaux d'un lac sans nom, autre que celui mentionné à l'article 26, situé à environ 20 km à l'ouest de Fermont, Québec | Une partie d'un ruisseau sans nom évacuant les eaux d'un lac sans nom, autre que celui mentionné à l'article 26, situé à environ 20 km à l'ouest de la ville de Fermont, au Québec, et, plus précisément, la partie du ruisseau s'étendant sur une distance de 1815 m, au sud et en aval à partir du point situé par 52°50′02″ de latitude N. et 67°21′29″ de longitude O. jusqu'au point situé par 52°49′20″ de latitude N. et 67°21′39″ de longitude O. |
| 28 | Une partie du ruisseau South Teigen, Colombie-Britannique | La partie du ruisseau South Teigen située à environ 65 km au nord-ouest de Stewart, en Colombie-Britannique, et, plus précisément, la partie du ruisseau qui s'étend sur 8,1 km vers le nord-ouest et en aval d'un point situé par 56°37′53″ de latitude N. et 129°54′44″ de longitude O. jusqu'au centre d'un barrage situé par 56°40′11,57″ de latitude N. et 129°58′20,92″ de longitude O. |
| 29 | Une partie du ruisseau North Treaty, Colombie-Britannique | La partie du ruisseau North Treaty située à environ 65 km au nord-ouest de Stewart, en Colombie-Britannique, et, plus précisément, la partie du ruisseau qui s'étend sur 3,3 km vers le sud et en aval des eaux d'amont du ruisseau situé par 56°37′34″ de latitude N. et 129°54′50″ de longitude O. jusqu'au centre d'un barrage situé par 56°35′54,24″ de latitude N. et 129°51′25,31″ de longitude O. |
| 30 | Un cours d'eau sans nom tributaire du lac Jean, situé à environ 25 km au sud-est de Chibougamau, Québec | Le cours d'eau sans nom tributaire du lac Jean, situé à environ 25 km au sud-est de la ville de Chibougamau, au Québec, débutant à l'étang sans nom situé par 49°47′58″ de latitude N. et 74°01′38″ de longitude O. et s'étendant vers le nord et en aval sur une distance de 6,4 km jusqu'au centre du barrage situé par 49°49′29″ de latitude N. et 74°03′07″ de longitude O. |
| 31 | Une partie d'un cours d'eau sans nom tributaire du cours d'eau visé à l'article 30 | La partie d'un cours d'eau sans nom débutant au point de confluence de celui-ci avec le cours d'eau visé à l'article 30 situé par 49°47′57″ de latitude N. et 74°03′25″ de longitude O. et s'étendant vers le nord et en amont de ce point sur une distance de 1 km. |
| 32 | Une partie d'un cours d'eau sans nom tributaire du cours d'eau visé à l'article 30 | La partie du cours d'eau sans nom débutant au point situé par 49°48′06″ de latitude N. et 74°03′41″ de longitude O. et s'étendant vers le nord et en aval de ce point sur une distance de 740 m jusqu'au point de confluence avec le cours d'eau visé à l'article 30 situé par 49°48′25″ de latitude N. et 74°03′25″ de longitude O. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 32 | A portion of an unnamed watercourse that is a tributary to the watercourse referred to in item 30 | A portion of an unnamed watercourse beginning at a point located at 49°48′06″ north latitude and 74°03′41″ west longitude and extending for a distance of 740 m northwards and downstream from that point to the point of confluence with the watercourse referred to in item 30, which confluence is located at 49°48′25″ north latitude and 74°03′25″ west longitude. |
| 33 | An unnamed pond east of Lake Bernadette, Quebec, and a portion of its outlet | An unnamed pond located at 49°48′43″ north latitude and 74°04′01″ west longitude and a portion of its outlet extending from the mouth of the outlet located at 49°48′47″ north latitude and 74°03′59″ west longitude for a distance of 190 m northwards and downstream from that mouth. |
| 34 | A portion of an unnamed creek (locally known as Loslo Creek), and of its unnamed tributaries, that is tributary to Pinewood River, Ontario | A portion of an unnamed creek (locally known as Loslo Creek), and of its unnamed tributaries, that is tributary to Pinewood River, located approximately 65 km northwest of the town of Fort Frances, Ontario. More precisely, the portion extending southwards and downstream from the northernmost point of the creek at 48°53′6″ north latitude and 94°2′43″ west longitude to the point located at 48°50′24″ north latitude and 94°3′36″ west longitude. |
| 35 | A portion of an unnamed creek (locally known as Marr Creek), and of its unnamed tributaries, that is tributary to Pinewood River, Ontario | A portion of an unnamed creek (locally known as Marr Creek), and of its unnamed tributaries, that is tributary to Pinewood River, located approximately 65 km northwest of the town of Fort Frances, Ontario. More precisely, the portion extending southwards and downstream from the northernmost point of the creek at 48°52′12″ north latitude and 94°1′49″ west longitude to the point located at 48°51′18″ north latitude and 94°2′25″ west longitude. |
| 36 | A portion of an unnamed creek (locally known as Marr Creek), other than the portion referred to in item 35, that is tributary to Pinewood River, Ontario | A portion of an unnamed creek (locally known as Marr Creek), other than the portion referred to in item 35, that is tributary to Pinewood River, located approximately 65 km northwest of the town of Fort Frances, Ontario. More precisely, the portion extending southwards and downstream from the point located at 48°50′52″ north latitude and 94°2′11″ west longitude, for a distance of 1.85 km, to the point located at 48°49′53″ north latitude and 94°2′24″ west longitude. |
| 37 | A portion of an unnamed stream and its unnamed tributaries located approximately 25 km northwest of the town of Amos, Quebec | A portion of an unnamed stream and its unnamed tributaries located approximately 25 km northwest of the town of Amos, Quebec. More precisely, the 4.6 km portion of the stream extending from the point located at 48°40′44.00″ north latitude and 78°29′12.68″ west longitude to the point located at 48°40′7.19″north latitude and 78°28′1.52″ west longitude and covering an area of 3.4 ha. |

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 33 | Un étang sans nom à l'est du lac Bernadette, Québec, et une partie de sa décharge | Un étang sans nom situé par 49°48′43″ de latitude N. et 74°04′01″ de longitude O. et une partie de sa décharge s'étendant de l'embouchure de celle-ci située par 49°48′47″ de latitude N. et 74°03′59″ de longitude O. sur une distance de 190 m vers le nord en aval de son embouchure. |
| 34 | Une partie d'un ruisseau sans nom (connu localement sous le nom de ruisseau Loslo) et de ses tributaires sans nom, qui est tributaire de la rivière Pinewood, Ontario | La partie d'un ruisseau sans nom (connu localement sous le nom de ruisseau Loslo) et de ses tributaires sans nom, qui est tributaire de la rivière Pinewood, située à environ 65 km au nord-ouest de la ville de Fort Frances, en Ontario, et, plus précisément, la partie qui s'étend vers le sud et en aval du point le plus au nord du ruisseau situé par 48°53′6″ de latitude N. et 94°2′43″ de longitude O., jusqu'au point situé par 48°50′24″ de latitude N. et 94°3′36″ de longitude O. |
| 35 | Une partie d'un ruisseau sans nom (connu localement sous le nom de ruisseau Marr) et de ses tributaires sans nom, qui est tributaire de la rivière Pinewood, Ontario | La partie d'un ruisseau sans nom (connu localement sous le nom de ruisseau Marr) et de ses tributaires sans nom, qui est tributaire de la rivière Pinewood, située à environ 65 km au nord-ouest de la ville de Fort Frances, en Ontario, et, plus précisément, la partie qui s'étend vers le sud et en aval du point le plus au nord du ruisseau situé par 48°52′12″ de latitude N. et 94°1′49″ de longitude O., jusqu'au point situé par 48°51′18″ de latitude N. et 94°2′25″ de longitude O. |
| 36 | Une partie d'un ruisseau sans nom (connu localement sous le nom de ruisseau Marr), autre que la partie mentionnée à l'article 35, qui est tributaire de la rivière Pinewood, Ontario | La partie d'un ruisseau sans nom (connu localement sous le nom de ruisseau Marr), autre que la partie mentionnée à l'article 35, qui est tributaire de la rivière Pinewood, située à environ 65 km au nord-ouest de la ville de Fort Frances, en Ontario, et, plus précisément, la partie qui s'étend vers le sud et en aval du point situé par 48°50′52″ de latitude N. et 94°2′11″ de longitude O., sur une distance de 1,85 km, jusqu'au point situé par 48°49′53″ de latitude N. et 94°2′24″ de longitude O. |
| 37 | Une partie d'un ruisseau sans nom, et ses tributaires sans nom, située à environ 25 km au nord-ouest de la ville d'Amos, Québec | La partie d'un ruisseau sans nom, et ses tributaires sans nom, située à environ 25 km au nord-ouest de la ville d'Amos, au Québec, et, plus précisément, la partie du ruisseau qui s'étend sur 4,6 km à partir du point situé par 48°40′44,00″ de latitude N. et 78°29′12,68″ de longitude O. jusqu'au point situé par 48°40′7,19″ de latitude N. et 78°28′1,52″ de longitude O. et qui couvre une superficie de 3,4 ha. |
| 38 | Une partie d'un tributaire sans nom du Petit lac du Portage, Québec | La partie d'un tributaire sans nom du Petit lac du Portage située à environ 15 km au nord-ouest de la ville de Sept-Îles, au Québec. Plus précisément, la partie qui s'étend sur 465 m vers le sud-ouest et en amont du point situé par 50°16′00,90″ de latitude N. et 66°33′42,71″ de longitude O. jusqu'au point situé par 50°16′06,00″ de latitude N. et 66°33′31,55″ de longitude O. et qui couvre une superficie de 0,233 ha. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 38 | A portion of an unnamed tributary to Petit lac du Portage, Quebec | A portion of an unnamed tributary to Petit lac du Portage located approximately 15 km northwest of the town of Sept-Îles, Quebec. More precisely, the 465 m portion of the tributary to Petit lac du Portage extending southwest and upstream from the point located at 50°16′00.90″ north latitude and 66°33′42.71″ west longitude to the point located at 50°16′06.00″ north latitude and 66°33′31.55″ west longitude and covering an area of 0.233 ha. |
| 39 | An unnamed headwater pond of ruisseau Clet and its unnamed tributaries, Quebec | An unnamed headwater pond of ruisseau Clet located at 50°15′15.82″ north latitude and 66°33′13.6″ west longitude and covering an area of 2.486 ha, approximately 15 km northwest of the town of Sept-Îles, Quebec, and<br>**(a)** a 471 m portion of its unnamed tributary extending upstream from the point located at 50°15′18.37″ north latitude and 66°33′24.01″ west longitude to the point located at 50°15′20.27″ north latitude and 66°33′13.51″ west longitude and covering an area of 0.117 ha; and<br>**(b)** a 76 m portion of its unnamed tributary extending upstream from the point located at 50°15′11.97″ north latitude and 66°33′22.57″ west longitude to the point located at 50°15′12.82″ north latitude and 66°33′20.66″ west longitude and covering an area of 0.033 ha. |
| 40 | A portion of ruisseau Clet and its unnamed tributaries, Quebec | A portion of ruisseau Clet, and its unnamed tributaries, located approximately 15 km northwest of the town of Sept-Îles, Quebec. More precisely, the 1897 m portion of ruisseau Clet extending southeast and downstream from the outlet of the unnamed headwater pond referred to in item 39 to the point on ruisseau Clet located at 50°15′11.26″ north latitude and 66°32′15.99″ west longitude and covering an area of 0.850 ha. |
| 41 | An unnamed watercourse that is a tributary to Rivière Hall, Quebec | An unnamed watercourse that is composed of interconnected streams and ponds and is a tributary to Rivière Hall and located approximately 15 km northwest of the town of Sept-Îles, Quebec. More precisely, the 910 m portion of the unnamed watercourse extending downstream from the point located at 50°14′52.33″ north latitude and 66°33′27.75″ west longitude to the point located at 50°14′39.67″ north latitude and 66°32′45.74″ west longitude and covering an area of 3.619 ha. |

| Article | Colonne 1<br>Eaux ou lieux | Colonne 2<br>Description |
|---|---|---|
| 39 | Un étang d'amont sans nom du ruisseau Clet et ses tributaires sans nom, Québec | L'étang d'amont sans nom du ruisseau Clet qui est situé par 50°15′15,82″ de latitude N. et 66°33′13,6″ de longitude O. et qui couvre une superficie de 2,486 ha, à environ 15 km au nord-ouest de la ville de Sept-Îles, au Québec, et :<br>**a)** la partie de son tributaire sans nom qui s'étend sur 471 m en amont du point situé par 50°15′18,37″ de latitude N. et 66°33′24,01″ de longitude O. jusqu'au point situé par 50°15′20,27″ de latitude N. et 66°33′13,51″ de longitude O. et qui couvre une superficie de 0,117 ha;<br>**b)** la partie de son tributaire sans nom qui s'étend sur 76 m en amont du point situé par 50°15′11,97″ de latitude N. et 66°33′22,57″ de longitude O. jusqu'au point situé par 50°15′12,82″ de latitude N. et 66°33′20,66″ de longitude O. et qui couvre une superficie de 0,033 ha. |
| 40 | Une partie du ruisseau Clet et ses tributaires sans nom, Québec | La partie du ruisseau Clet, et ses tributaires sans nom, située à environ 15 km au nord-ouest de la ville de Sept-Îles, au Québec, et, plus précisément, la partie du ruisseau qui s'étend sur 1 897 m vers le sud-est et en aval de la décharge de l'étang d'amont sans nom visé à l'article 39 jusqu'au point du ruisseau situé par 50°15′11,26″ de latitude N. et 66°32′15,99″ de longitude O. et qui couvre une superficie de 0,850 ha. |
| 41 | Un cours d'eau sans nom tributaire de la rivière Hall, Québec | Le cours d'eau sans nom qui est composé de ruisseaux et d'étangs interconnectés, qui est tributaire de la rivière Hall et qui est situé à environ 15 km au nord-ouest de la ville de Sept-Îles, au Québec. Plus précisément, la partie du cours d'eau sans nom qui s'étend sur 910 m en amont du point situé par 50°14′52,33″ de latitude N. et 66°33′27,75″ de longitude O. jusqu'au point situé par 50°14′39,67″ de latitude N. et 66°32′45,74″ de longitude O. et qui couvre une superficie de 3,619 ha. |
| 42 | Des parties d'un ruisseau sans nom, Québec | Les deux parties d'un ruisseau sans nom situées à environ 15 km au nord-ouest de la ville de Sept-Îles, au Québec, et, plus précisément :<br>**a)** la partie ouest du ruisseau qui s'étend sur 253 m du point situé par 50°15′18,78″ de latitude N. et 66°29′52,43″ de longitude O. jusqu'au point situé par 50°15′13,76″ de latitude N. et 66°29′46,60″ de longitude O. et qui couvre une superficie de 0,0585 ha;<br>**b)** la partie est du ruisseau qui s'étend sur 267 m du point situé par 50°15′19,58″ de latitude N. et 66°29′45,99″ de longitude O. jusqu'au point situé par 50°15′14,18″ de latitude N. et 66°29′45,19″ de longitude O. et qui couvre une superficie de 0,0555 ha. |

| Item | Column 1<br>Water or Place | Column 2<br>Description |
|---|---|---|
| 42 | Portions of an unnamed creek, Quebec | Two portions of an unnamed creek located approximately 15 km northwest of the town of Sept-Îles, Quebec. More precisely,<br>**(a)** the west portion of the creek extending for a distance of 253 m from the point located at 50°15′18.78″ north latitude and 66°29′52.43″ west longitude to the point located at 50°15′13.76″ north latitude and 66°29′46.60″ west longitude and covering 0.0585 ha; and<br>**(b)** the east portion of the creek extending for a distance of 267 m from the point located at 50°15′19.58″ north latitude and 66°29′45.99″ west longitude to the point located at 50°15′14.18″ north latitude and 66°29′45.19″ west longitude and covering 0.0555 ha. |

SOR/2006-239, ss. 21 to 23; SOR/2008-216, s. 1; SOR/2009-27, s. 1; SOR/2009-156, s. 2; SOR/2010-250, s. 1; SOR/2011-202, s. 1; SOR/2015-45, s. 1; SOR/2016-87, s. 1; SOR/2016-196, s. 1; SOR/2017-128, s. 1; SOR/2017-129, s. 1; SOR/2017-197, s. 1; SOR/2017-272, s. 1; SOR/2018-100, s. 1.

DORS/2006-239, art. 21 à 23; DORS/2008-216, art. 1; DORS/2009-27, art. 1; DORS/2009-156, art. 2; DORS/2010-250, art. 1; DORS/2011-202, art. 1; DORS/2015-45, art. 1; DORS/2016-87, art. 1; DORS/2016-196, art. 1; DORS/2017-128, art. 1; DORS/2017-129, art. 1; DORS/2017-197, art. 1; DORS/2017-272, art. 1; DORS/2018-100, art. 1.

## SCHEDULE 3

(Subsections 1(1) and 12(2) and subsection 4(2) of Schedule 5)

# Analytical Requirements for Metal or Diamond Mining Effluent

### TABLE 1

| Item | Column 1<br>Deleterious Substance/pH/ temperature | Column 2<br>Precision[1] | Column 3<br>Accuracy[2] | Column 4<br>Method Detection Limit (MDL) |
|---|---|---|---|---|
| 1 | Arsenic | 10% | 100 ± 10% | 0.0025 mg/L |
| 2 | Copper | 10% | 100 ± 10% | 0.001 mg/L |
| 3 | Cyanide | 10% | 100 ± 10% | 0.005 mg/L |
| 4 | Lead | 10% | 100 ± 10% | 0.0005 mg/L |
| 5 | Nickel | 10% | 100 ± 10% | 0.0125 mg/L |
| 6 | Zinc | 10% | 100 ± 10% | 0.010 mg/L |
| 7 | Suspended Solids | 15% | 100 ± 15% | 2.000 mg/L |
| 8 | Radium 226 | 10% | 100 ± 10% | 0.01 Bq/L |
| 9 | Total ammonia | 10% | 100 ± 10% | 0.05 mg/L expressed as nitrogen (N) |
| 10 | pH | 0.1 pH unit | 0.1 pH unit | Not Applicable |
| 11 | Temperature | 10% | ± 0.5 °C | Not Applicable |

[1] Relative standard deviation at concentrations 10 times above the MDL.

[2] Analyte recovery at concentrations above 10 times the MDL.

### TABLE 2

| Item | Column 1<br>Substances/ hardness/ alkalinity/ electrical conductivity | Column 2<br>Precision[1] | Column 3<br>Accuracy[2] | Column 4<br>Method Detection Limit (MDL) |
|---|---|---|---|---|
| 1 | Aluminum | 10% | 100 ± 10% | 0.005 mg/L |
| 2 | Cadmium | 10% | 100 ± 10% | 0.000045 mg/L |
| 3 | Chloride | 10% | 100 ± 10% | 60 mg/L |

## ANNEXE 3

(paragraphes 1(1) et 12(2) et paragraphe 4(2) de l'annexe 5)

# Exigences analytiques pour les effluents des mines de métaux et des mines de diamants

### TABLEAU 1

| Article | Colonne 1<br>Substance nocive/pH/ température | Colonne 2<br>Précision[1] | Colonne 3<br>Exactitude[2] | Colonne 4<br>Limite de détection de la méthode (LDM) |
|---|---|---|---|---|
| 1 | Arsenic | 10 % | 100 ± 10 % | 0,0025 mg/L |
| 2 | Cuivre | 10 % | 100 ± 10 % | 0,001 mg/L |
| 3 | Cyanure | 10 % | 100 ± 10 % | 0,005 mg/L |
| 4 | Plomb | 10 % | 100 ± 10 % | 0,0005 mg/L |
| 5 | Nickel | 10 % | 100 ± 10 % | 0,0125 mg/L |
| 6 | Zinc | 10 % | 100 ± 10 % | 0,010 mg/L |
| 7 | Matières en suspension | 15 % | 100 ± 15 % | 2,000 mg/L |
| 8 | Radium 226 | 10 % | 100 ± 10 % | 0,01 Bq/L |
| 9 | Ammoniac total | 10 % | 100 ± 10 % | 0,05 mg/L sous forme d'azote (N) |
| 10 | pH | 0,1 unité pH | 0,1 unité pH | Sans objet |
| 11 | Température | 10 % | ± 0,5 °C | Sans objet |

[1] Écart-type relatif à des concentrations dix fois supérieures à la LDM.

[2] Récupération de l'analyte à des concentrations de plus de dix fois la LDM.

### TABLEAU 2

| Article | Colonne 1<br>Substance/ dureté/ alcalinité/ conductivité électrique | Colonne 2<br>Précision[1] | Colonne 3<br>Exactitude[2] | Colonne 4<br>Limite de détection de la méthode (LDM) |
|---|---|---|---|---|
| 1 | Aluminium | 10 % | 100 ± 10 % | 0,005 mg/L |
| 2 | Cadmium | 10 % | 100 ± 10 % | 0,000045 mg/L |
| 3 | Chlorure | 10 % | 100 ± 10 % | 60 mg/L |

| Item | Column 1<br>Substances/ hardness/ alkalinity/ electrical conductivity | Column 2<br>Precision[1] | Column 3<br>Accuracy[2] | Column 4<br>Method Detection Limit (MDL) |
|---|---|---|---|---|
| 4 | Chromium | 10% | 100 ± 10% | 0.00445 mg/L |
| 5 | Cobalt | 10% | 100 ± 10% | 0.00125 mg/L |
| 6 | Iron | 10% | 100 ± 10% | 0.15 mg/L |
| 7 | Manganese | 10% | 100 ± 10% | 0.005 mg/L |
| 8 | Mercury | 10% | 100 ± 10% | 0.00001 mg/L |
| 9 | Molybdenum | 10% | 100 ± 10% | 0.0365 mg/L |
| 10 | Nitrate | 10% | 100 ± 10% | 1.46835 mg/L, expressed as nitrogen (N) |
| 11 | Phosphorus | 10% | 100 ± 10% | 0.05 mg/L |
| 12 | Selenium | 10% | 100 ± 10% | 0.0005 mg/L |
| 13 | Sulphate | 10% | 100 ± 10% | 0.6 mg/L |
| 14 | Thallium | 10% | 100 ± 10% | 0.0004 mg/L |
| 15 | Uranium | 10% | 100 ± 10% | 0.0075 mg/L |
| 16 | Total ammonia | 10% | 100 ± 10% | 0.05 mg/L expressed as nitrogen (N) |
| 17 | Hardness | 10% | 100 ± 10% | 1 mg/L |
| 18 | Alkalinity | 10% | 100 ± 10% | 2 mg/L |
| 19 | Electrical Conductivity | 10% | 100 ± 10% | 1 µS/cm |

[1] Relative standard deviation at concentrations 10 times above the MDL.

[2] Analyte recovery at concentrations above 10 times the MDL.

SOR/2006-239, s. 24; SOR/2018-99, s. 31.

| Article | Colonne 1<br>Substance/ dureté/ alcalinité/ conductivité électrique | Colonne 2<br>Précision[1] | Colonne 3<br>Exactitude[2] | Colonne 4<br>Limite de détection de la méthode (LDM) |
|---|---|---|---|---|
| 4 | Chrome | 10 % | 100 ± 10 % | 0,00445 mg/L |
| 5 | Cobalt | 10 % | 100 ± 10 % | 0,00125 mg/L |
| 6 | Fer | 10 % | 100 ± 10 % | 0,15 mg/L |
| 7 | Manganèse | 10 % | 100 ± 10 % | 0,005 mg/L |
| 8 | Mercure | 10 % | 100 ± 10 % | 0,00001 mg/L |
| 9 | Molybdène | 10 % | 100 ± 10 % | 0,0365 mg/L |
| 10 | Nitrate | 10 % | 100 ± 10 % | 1,46835 mg/L sous forme d'azote (N) |
| 11 | Phosphore | 10 % | 100 ± 10 % | 0,05 mg/L |
| 12 | Sélénium | 10 % | 100 ± 10 % | 0,0005 mg/L |
| 13 | Sulfate | 10 % | 100 ± 10 % | 0,6 mg/L |
| 14 | Thallium | 10 % | 100 ± 10 % | 0,0004 mg/L |
| 15 | Uranium | 10 % | 100 ± 10 % | 0,0075 mg/L |
| 16 | Ammoniac total | 10 % | 100 ± 10 % | 0,05 mg/L sous forme d'azote (N) |
| 17 | Dureté | 10 % | 100 ± 10 % | 1 mg/L |
| 18 | Alcalinité | 10 % | 100 ± 10 % | 2 mg/L |
| 19 | Conductivité électrique | 10 % | 100 ± 10 % | 1 µS/cm |

[1] Écart-type relatif à des concentrations dix fois supérieures à la LDM.

[2] Récupération de l'analyte à des concentrations de plus de dix fois la LDM.

DORS/2006-239, art. 24; DORS/2018-99, art. 31.

## SCHEDULE 4

(Paragraph 4(1)(a), subsection 13(1), paragraph 13(3)(a), subparagraph 22(c)(i) and paragraph 24(1)(a))

# Authorized Limits of Deleterious Substances

| Item | Column 1<br>Deleterious Substance | Column 2<br>Maximum Authorized Monthly Mean Concentration | Column 3<br>Maximum Authorized Concentration in a Composite Sample | Column 4<br>Maximum Authorized Concentration in a Grab Sample |
|---|---|---|---|---|
| 1 | Arsenic | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |
| 2 | Copper | 0.30 mg/L | 0.45 mg/L | 0.60 mg/L |
| 3 | Cyanide | 1.00 mg/L | 1.50 mg/L | 2.00 mg/L |
| 4 | Lead | 0.20 mg/L | 0.30 mg/L | 0.40 mg/L |
| 5 | Nickel | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |
| 6 | Zinc | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |
| 7 | Total Suspended Solids | 15.00 mg/L | 22.50 mg/L | 30.00 mg/L |
| 8 | Radium 226 | 0.37 Bq/L | 0.74 Bq/L | 1.11 Bq/L |

NOTE: All concentrations are total values.

SOR/2006-239, s. 25; SOR/2018-99, s. 32.

## ANNEXE 4

(alinéa 4(1)a), paragraphe 13(1), alinéa 13(3)a), sous-alinéa 22c)(i) et alinéa 24(1)a))

# Limites permises pour certaines substances nocives

| Article | Colonne 1<br>Substance nocive | Colonne 2<br>Concentration moyenne mensuelle maximale permise | Colonne 3<br>Concentration maximale permise dans un échantillon composite | Colonne 4<br>Concentration maximale permise dans un échantillon instantané |
|---|---|---|---|---|
| 1 | Arsenic | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 2 | Cuivre | 0,30 mg/L | 0,45 mg/L | 0,60 mg/L |
| 3 | Cyanure | 1,00 mg/L | 1,50 mg/L | 2,00 mg/L |
| 4 | Plomb | 0,20 mg/L | 0,30 mg/L | 0,40 mg/L |
| 5 | Nickel | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 6 | Zinc | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 7 | Total des solides en suspension | 15,00 mg/L | 22,50 mg/L | 30,00 mg/L |
| 8 | Radium 226 | 0,37 Bq/L | 0,74 Bq/L | 1,11 Bq/L |

NOTE : Toutes les concentrations sont des valeurs totales.

DORS/2006-239, art. 25; DORS/2018-99, art. 32.

**SCHEDULE 5**

(Subsections 7(1) and (3) and paragraphs 15(1)(a) and (b) and 32(1)(c))

# Environmental Effects Monitoring Studies

## Interpretation

**1 (1)** The following definitions apply in this Schedule.

***biological monitoring study*** means a study referred to in section 9. (*étude de suivi biologique*)

***effect on fish tissue from mercury*** means a concentration of total mercury that exceeds 0.5 µg/g wet weight in fish tissue that is taken in an exposure area and that is statistically different from and higher than the concentration of total mercury in fish tissue that is taken in a reference area. (*effet du mercure sur les tissus de poissons*)

***effect on the benthic invertebrate community*** means a statistical difference between data referred to in subparagraph 12(1)(e)(ii) and paragraph 12(1)(f) from a study respecting the benthic invertebrate community conducted in

**(a)** an exposure area and a reference area; or

**(b)** sampling areas within an exposure area where there are gradually decreasing effluent concentrations. (*effet sur la communauté d'invertébrés benthiques*)

***effect on the fish population*** means a statistical difference between data relating to the indicators referred to in subparagraph 12(1)(e)(i) from a study respecting fish population conducted in

**(a)** an exposure area and a reference area; or

**(b)** sampling areas within an exposure area where there are gradually decreasing effluent concentrations. (*effet sur la population de poissons*)

***exposure area*** means all fish habitat and waters frequented by fish that are exposed to effluent. (*zone exposée*)

***fish*** has the same meaning as in section 2 of the Act but does not include parts of fish, parts of shellfish, parts of crustaceans or parts of marine animals. (*poisson*)

***reference area*** means water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as practicable, is most similar to that of the exposure area. (*zone de référence*)

***sampling area*** means the area within an exposure or reference area where representative samples are collected. (*zone d'échantillonnage*)

**ANNEXE 5**

(paragraphes 7(1) et (3), alinéas 15(1)a) et b) et 32(1)c))

# Études de suivi des effets sur l'environnement

## Définitions et interprétation

**1 (1)** Les définitions qui suivent s'appliquent à la présente annexe.

***effet du mercure sur les tissus de poissons*** Concentration du mercure total dans les tissus de poissons pris dans la zone exposée, supérieure à 0,5 µg/g (poids humide), présentant une différence statistique et ayant une concentration plus élevée par rapport à la concentration du mercure total dans les tissus de poissons pris dans la zone de référence. (*effect on fish tissue from mercury*)

***effet sur la communauté d'invertébrés benthiques*** Différence statistique entre les données visées au sous-alinéa 12(1)e)(ii) et à l'alinéa 12(1)f) d'une étude sur la communauté d'invertébrés benthiques effectuée :

**a)** soit dans la zone exposée et dans la zone de référence;

**b)** soit dans les zones d'échantillonnage de la zone exposée qui présentent un gradient décroissant de concentration d'effluent. (*effect on the benthic invertebrate community*)

***effet sur la population de poissons*** Différence statistique entre les données portant sur les indicateurs visés au sous-alinéa 12(1)e)(i) d'une étude sur la population de poissons effectuée :

**a)** soit dans la zone exposée et dans la zone de référence;

**b)** soit dans les zones d'échantillonnage de la zone exposée qui présentent un gradient décroissant de concentration d'effluent. (*effect on the fish population*)

***étude de suivi biologique*** Étude visée à l'article 9. (*biological monitoring study*)

***poisson*** S'entend au sens de l'article 2 de la Loi, à l'exclusion des parties de poissons, de mollusques, de crustacés et d'animaux marins. (*fish*)

***zone d'échantillonnage*** Partie de la zone exposée ou de la zone de référence où les échantillons représentatifs sont prélevés. (*sampling area*)

***zone de référence*** Les eaux où vivent des poissons et où se trouve un habitat du poisson, qui ne sont pas exposées à un effluent et qui présentent, dans la mesure du possible, les caractéristiques les plus semblables à celles de la zone exposée. (*reference area*)

**(2)** For the purpose of this schedule, ***critical effect size***, in relation to an effect indicator set out in column 1 of the following table, means the critical effect size set out in column 2:

| Item | Column 1<br>Effect Indicator | Column 2<br>Critical Effect Size |
|---|---|---|
| | For Fish Population | (% of reference mean) |
| 1 | Total body weight at age | ± 25% |
| 2 | Gonad weight at total body weight | ± 25% |
| 3 | Liver weight at total body weight | ± 25% |
| 4 | Total body weight at length (condition) | ± 10% |
| 5 | Age | ± 25% |
| | For Benthic Invertebrate Community | (Standard Deviation Units) |
| 6 | Density | ± 2 SD |
| 7 | Simpson's Evenness Index | ± 2 SD |
| 8 | Taxa Richness | ± 2 SD |

**2** Environmental effects monitoring studies consist of the effluent and water quality monitoring studies set out in Part 1 and the biological monitoring studies set out in Part 2.

## PART 1

# Effluent and Water Quality Monitoring Studies

## Required Studies

**3** Effluent and water quality monitoring studies consist of effluent characterization, sublethal toxicity testing and water quality monitoring.

***zone exposée*** Les eaux où vivent des poissons et l'habitat du poisson qui sont exposés à un effluent. (*exposure area*)

**(2)** Pour l'application de la présente annexe, ***seuil critique d'effet*** s'entend, à l'égard d'un indicateur d'effet qui figure dans la colonne 1 du tableau ci-après, du seuil critique d'effet correspondant de la colonne 2 :

| Article | Colonne 1<br>Indicateur d'effet | Colonne 2<br>Seuil critique d'effet |
|---|---|---|
| | Pour la population de poissons | (% par rapport à la moyenne de référence) |
| 1 | Poids corporel total selon l'âge | ± 25 % |
| 2 | Poids des gonades par rapport au poids corporel total | ± 25 % |
| 3 | Poids du foie par rapport au poids corporel total | ± 25 % |
| 4 | Poids corporel total par rapport à la longueur (condition) | ± 10 % |
| 5 | Âge | ± 25 % |
| | Pour la communauté d'invertébrés benthiques | (multiple d'écart type) |
| 6 | Densité | ± 2 ET |
| 7 | Indice de régularité de Simpson | ± 2 ET |
| 8 | Richesse des taxons | ± 2 ET |

**2** Les études de suivi des effets sur l'environnement se composent des études de suivi de l'effluent et de la qualité de l'eau prévues à la partie 1 et des études de suivi biologique prévues à la partie 2.

## PARTIE 1

# Études de suivi de l'effluent et de la qualité de l'eau

## Composition des études

**3** Les études de suivi de l'effluent et de la qualité de l'eau se composent de la caractérisation de l'effluent, des essais de toxicité sublétale et du suivi de la qualité de l'eau.

# Effluent Characterization

**4 (1)** Effluent characterization is conducted by analyzing a sample of effluent and recording the hardness, alkalinity, electrical conductivity and temperature of the sample and the concentrations, in total values, of the following substances:

**(a)** aluminum;

**(b)** cadmium;

**(c)** iron;

**(d)** subject to subsection (4), mercury;

**(e)** molybdenum;

**(f)** selenium;

**(g)** nitrate (concentration in units of nitrogen);

**(h)** chloride;

**(i)** chromium;

**(j)** cobalt;

**(k)** sulphate;

**(l)** thallium;

**(m)** uranium;

**(n)** phosphorus (concentration in units of phosphorus);

**(o)** manganese; and

**(p)** ammonia (concentration in units of nitrogen).

**(2)** The analysis shall comply with the analytical requirements set out in Table 2 of Schedule 3.

**(3)** The effluent characterization shall be conducted once per calendar quarter on an aliquot of effluent sample collected under sections 12 and 13 of these Regulations from each final discharge point at least one month after the sample on which the previous characterization was conducted.

**(4)** The recording of the concentration of mercury in effluent referred to in paragraph (1)(d) may be discontinued if that concentration is less than 0.10 µg/L in 12 consecutive samples collected under subsection (3).

**(5)** Quality assurance and quality control measures shall be implemented that will ensure the accuracy of the effluent characterization data.

# Caractérisation de l'effluent

**4 (1)** La caractérisation de l'effluent est effectuée par l'analyse d'un échantillon d'effluent et par l'enregistrement de sa dureté, de son alcalinité, de sa conductivité électrique, de sa température et des concentrations, exprimées en valeurs totales, des substances suivantes :

**a)** l'aluminium;

**b)** le cadmium;

**c)** le fer;

**d)** sous réserve du paragraphe (4), le mercure;

**e)** le molybdène;

**f)** le sélénium;

**g)** le nitrate (la concentration en unités d'azote);

**h)** le chlorure;

**i)** le chrome;

**j)** le cobalt;

**k)** le sulfate;

**l)** le thallium;

**m)** l'uranium;

**n)** le phosphore (la concentration en unités de phosphore);

**o)** le manganèse;

**p)** l'ammoniac (la concentration en unités d'azote).

**(2)** Les analyses doivent satisfaire aux exigences analytiques prévues au tableau 2 de l'annexe 3.

**(3)** La caractérisation de l'effluent est effectuée, une fois par trimestre civil, sur une portion aliquote de l'échantillon d'effluent prélevé à chaque point de rejet final en application des articles 12 et 13 du présent règlement au moins un mois après la caractérisation précédente.

**(4)** La concentration en mercure n'a plus à être enregistrée aux termes de l'alinéa (1)d) si la concentration de mercure de douze échantillons consécutifs prélevés selon le paragraphe (3) est inférieure à 0,10 µg/L.

**(5)** Des mesures d'assurance de la qualité et de contrôle de la qualité sont prises pour garantir l'exactitude des données visant la caractérisation de l'effluent.

# Sublethal Toxicity Testing

**5 (1)** Sublethal toxicity testing shall, in the case of effluent deposited into fresh waters, be conducted using the following test methodologies, as amended from time to time:

**(a)** in the case of a fish species,

**(i)** *Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows* (Report EPS 1/RM/22), published by the Department of the Environment, or

**(ii)** *Biological Test Method: Toxicity Tests Using Early Life Stages of Salmonid Fish (Rainbow Trout)* (Reference Method EPS 1/RM/28), published by the Department of the Environment;

**(b)** in the case of an invertebrate species, *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia* (Report EPS 1/RM/21), published by the Department of the Environment;

**(c)** in the case of a plant species, *Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte, Lemna minor* (Reference Method EPS 1/RM/37), published by the Department of the Environment, as it applies to the biological endpoint based on the number of fronds; and

**(d)** in the case of an algal species,

**(i)** *Biological Test Method: Growth Inhibition Test Using a Freshwater Alga* (Report EPS 1/RM/25), published by the Department of the Environment, or

**(ii)** *Détermination de la toxicité : inhibition de la croissance chez l'algue Pseudokirchneriella subcapitata*, (Méthode de référence MA 500 – P. sub. 1.0, rév. 3), published by the Centre d'expertise en analyse environnementale du Québec du ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques du Québec.

**(2)** Sublethal toxicity testing shall, in the case of effluent deposited into marine or estuarine waters, be conducted for fish species, invertebrate species and algal species using the following test methodologies, as amended from time to time, as applicable to each species:

**(a)** *Biological Test Method: Fertilization Assay Using Echinoids (Sea Urchins and Sand Dollars)* (Report EPS 1/RM/27), published by the Department of the Environment;

**(b)** *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms* (Reference Method EPA/821/R-02/014), published by the U.S. Environmental Protection Agency; and

# Essais de toxicité sublétale

**5 (1)** Dans le cas d'effluent rejeté dans l'eau douce, les essais de toxicité sublétale sont effectués en conformité avec les méthodes ci-après, avec leurs modifications successives :

**a)** dans le cas d'une espèce de poissons :

**(i)** soit la *Méthode d'essai biologique : essai de croissance et de survie sur des larves de tête-de-boule* (Rapport SPE 1/RM/22), publiée par le ministère de l'Environnement,

**(ii)** soit la *Méthode d'essai biologique : essais toxicologiques sur des salmonidés (truite arc-en-ciel) aux premiers stades de leur cycle biologique* (Méthode de référence SPE 1/RM/28), publiée par le ministère de l'Environnement;

**b)** dans le cas d'une espèce d'invertébré, la *Méthode d'essai biologique : essai de reproduction et de survie du cladocère Ceriodaphnia dubia* (Rapport SPE 1/RM/21), publiée par le ministère de l'Environnement;

**c)** dans le cas d'une espèce de plante, la *Méthode d'essai biologique : essai de mesure de l'inhibition de la croissance de la plante macroscopique dulcicole Lemna minor* (Méthode de référence SPE 1/RM/37), publiée par le ministère de l'Environnement et appliquée au paramètre biologique en fonction du nombre de thalles;

**d)** dans le cas d'une espèce d'algue :

**(i)** soit la *Méthode d'essai biologique : essai d'inhibition de la croissance d'une algue d'eau douce* (Rapport SPE 1/RM/25), publiée par le ministère de l'Environnement,

**(ii)** soit la méthode intitulée *Détermination de la toxicité : inhibition de la croissance chez l'algue Pseudokirchneriella subcapitata,* (Méthode de référence MA 500 – P. sub. 1.0, rév. 3), publiée par le Centre d'expertise en analyse environnementale du Québec du ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques du Québec.

**(2)** Dans le cas d'effluent rejeté dans l'eau de mer ou d'estuaire, les essais de toxicité sublétale sont effectués conformément aux méthodes ci-après, avec leurs modifications successives, à l'égard d'une espèce, selon le cas, de poisson, d'invertébré et d'algue :

**a)** la *Méthode d'essai biologique : essai sur la fécondation chez les échinides (oursins globuleux et oursins plats)* (Rapport SPE/1/RM/27), publiée par le ministère de l'Environnement;

**b)** les méthodes intitulées *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms* (Méthode de référence EPA/821/R-02/014), publiées par l'Environmental Protection Agency des États-Unis;

**(c)** *Short-term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to West Coast Marine and Estuarine Organisms* (Reference Method EPA/600/R-95-136), published by the U.S. Environmental Protection Agency.

**(3)** The sublethal toxicity tests shall be conducted on aliquots of the same effluent sample collected for effluent characterization collected from the mine's final discharge point that has potentially the most adverse environmental impact on the environment, taking into account

**(a)** the loading of the deleterious substances contained in the effluent as determined under subsection 20(2) of these Regulations; and

**(b)** the manner in which the effluent mixes within the exposure area.

**6 (1)** The sublethal toxicity tests shall be conducted on the species referred to in subsections 5(1) and (2) two times each calendar year for three years and each test shall be conducted on an aliquot of effluent sample collected at least one month after the collection of the sample used in the previous tests.

**(2)** However, if effluent is discharged for 31 consecutive days or less in a calendar year, the tests may be conducted only once in that year.

**(3)** After three years, the tests shall be conducted once per calendar quarter on the species referred to in subsection 5(1) or (2), as the case may be, whose results for all the tests conducted in accordance with subsections (1) and (2) — including such tests conducted in addition to the number required by those subsections — produce the lowest geometric mean, taking into account the inhibition concentration that produces a 25% effect or an effective concentration of 25%.

## Water Quality Monitoring

**7 (1)** Water quality monitoring is conducted by

**(a)** collecting samples of water from

**(i)** the exposure area surrounding the point of entry of effluent into water from each final discharge point and from the related reference areas, and

**(ii)** the sampling areas that are selected under clauses 10(b)(i)(B) and 10(c)(i)(A);

**(b)** recording the temperature of the water and the dissolved oxygen concentration in the water in the exposure and reference areas where the samples are collected;

**(c)** recording the concentration of the substances set out in paragraphs 4(1)(a) to (p) and,

**(i)** in the case of effluent that is deposited into fresh water, recording the pH, hardness, alkalinity and electrical conductivity of the water samples,

**c)** les méthodes intitulées *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms* (Méthode de référence EPA/600/R-95-136), publiées par l'Environmental Protection Agency des États-Unis.

**(3)** Les essais de toxicité sublétale sont effectués sur des portions aliquotes d'un même échantillon d'effluent prélevé pour la caractérisation de l'effluent au point de rejet final de la mine qui représente le plus grand risque de répercussions néfastes sur l'environnement, compte tenu :

**a)** de la charge des substances nocives se trouvant dans l'effluent, déterminée conformément au paragraphe 20(2) du présent règlement;

**b)** de la façon dont l'effluent se mélange dans la zone exposée.

**6 (1)** Les essais de toxicité sublétale sont effectués, à l'égard de chaque espèce visée aux paragraphes 5(1) et (2), à raison de deux fois par année civile pendant trois ans et chaque essai est effectué sur une portion aliquote de l'échantillon d'effluent prélevé au moins un mois après le prélèvement de l'échantillon utilisé pour les essais précédents.

**(2)** Toutefois, dans le cas de l'effluent rejeté pendant trente et un jours consécutifs ou moins dans une année civile, ces essais peuvent être effectués une fois pour cette année.

**(3)** Après trois ans, les essais sont effectués une fois par trimestre civil pour l'espèce visée au paragraphe 5(1) ou (2), selon le cas, à l'égard de laquelle les résultats de tous les essais effectués conformément aux paragraphes (1) ou (2) — y compris ceux excédant le nombre d'essais exigés par ces paragraphes — révèlent la moyenne géométrique la plus faible, compte tenu d'une concentration inhibitrice qui produit un effet de 25 % ou d'une concentration effective de 25 %.

## Suivi de la qualité de l'eau

**7 (1)** Le suivi de la qualité de l'eau s'effectue :

**a)** par prélèvement d'échantillons d'eau :

**(i)** dans la zone exposée entourant l'endroit où l'effluent rejeté par chaque point de rejet final se mélange à l'eau, et dans les zones de référence connexes,

**(ii)** dans les zones d'échantillonnage choisies aux termes des divisions 10b)(i)(B) et 10c)(i)(A);

**b)** par enregistrement de la température de l'eau et de la concentration d'oxygène dissous dans l'eau des zones exposées et des zones de référence où les échantillons sont prélevés;

**c)** par enregistrement de la concentration des substances énumérées aux alinéas 4(1)a) à p) et :

**(i)** dans le cas où l'effluent est rejeté dans l'eau douce, par enregistrement du pH, de la dureté, de l'alcalinité et de la conductivité électrique des échantillons d'eau,

**(ii)** in the case of effluent that is deposited into estuarine waters, recording the pH, hardness, alkalinity, electrical conductivity and salinity of the water samples, and

**(iii)** in the case of effluent that is deposited into marine waters, recording the salinity of the water samples;

**(d)** recording the concentration of the deleterious substances prescribed in section 3 of these Regulations, but

**(i)** not recording the concentrations of cyanide if that substance is not used as a process reagent within the operations area, and

**(ii)** not recording the concentrations of radium 226 if the conditions of subsection 13(2) of these Regulations are met; and

**(e)** implementing quality assurance and quality control measures that will ensure the accuracy of water quality monitoring data.

**(2)** The water quality monitoring shall be conducted

**(a)** four times per calendar year and at least one month apart on the samples of water collected, while the mine is depositing effluent, from the areas referred to in subparagraph (1)(a)(i); and

**(b)** at the same time that the biological monitoring studies are conducted on samples of water collected in the areas referred to in subparagraph (1)(a)(ii).

## Information Related to Effluent and Water Quality Monitoring Studies

**8** The following information in relation to the effluent and water quality monitoring studies conducted during a calendar year under sections 4 to 7 shall be submitted to the Minister of the Environment not later than March 31 of the following year:

**(a)** the dates on which samples were collected for effluent characterization, sublethal toxicity testing and water quality monitoring;

**(b)** for each sample collected for effluent characterization, the location of the final discharge point from which samples were collected for effluent characterization;

**(c)** the location of the final discharge point from which samples were collected for sublethal toxicity testing and the data used in selecting the final discharge point in accordance with subsection 5(3);

**(d)** the latitude and longitude of sampling areas for water quality monitoring and a description that is sufficient to identify the location of the sampling areas;

**(ii)** dans le cas où il est rejeté dans l'eau d'estuaire, par enregistrement du pH, de la dureté, de l'alcalinité, de la conductivité électrique et de la salinité des échantillons d'eau,

**(iii)** dans le cas où il est rejeté dans l'eau de mer, par enregistrement de la salinité des échantillons d'eau;

**d)** par enregistrement de la concentration des substances nocives désignées à l'article 3 du présent règlement, sous réserve de ce qui suit :

**(i)** la concentration de cyanure n'est enregistrée que si cette substance est utilisée comme réactif de procédé sur le chantier,

**(ii)** la concentration de radium 226 n'est pas enregistrée si les conditions mentionnées au paragraphe 13(2) du présent règlement sont remplies;

**e)** par la prise des mesures d'assurance de la qualité et de contrôle de la qualité pour garantir l'exactitude des données visant le suivi de la qualité de l'eau.

**(2)** Le suivi de la qualité de l'eau est effectué :

**a)** quatre fois par année civile et à au moins un mois d'intervalle sur les échantillons d'eau prélevés, lorsque la mine rejette de l'effluent, dans les zones visées au sous-alinéa (1)a)(i);

**b)** en même temps que les études de suivi biologique, sur les échantillons d'eau prélevés dans les zones visées au sous-alinéa (1)a)(ii).

## Renseignements relatifs aux études de suivi de l'effluent et de la qualité de l'eau

**8** Les renseignements ci-après, relatifs aux études de suivi de l'effluent et de la qualité de l'eau effectuées au cours d'une année civile en application des articles 4 à 7, sont présentés au ministre de l'Environnement au plus tard le 31 mars de l'année suivante :

**a)** les dates de prélèvement des échantillons pour la caractérisation de l'effluent, les essais de toxicité sublétale et le suivi de la qualité de l'eau;

**b)** l'emplacement des points de rejet final où les échantillons sont prélevés pour la caractérisation de l'effluent;

**c)** l'emplacement du point de rejet final où les échantillons ont été prélevés pour les essais de toxicité sublétale et les données qui ont servi à le sélectionner conformément au paragraphe 5(3);

**d)** la latitude et la longitude des zones d'échantillonnage utilisées pour le suivi de la qualité de l'eau et une description qui permet de reconnaître l'emplacement de ces zones;

**(e)** the results of effluent characterization, sublethal toxicity testing and water quality monitoring;

**(f)** the methodologies used to conduct effluent characterization and water quality monitoring, and the related method detection limits;

**(g)** a description of the quality assurance and quality control measures that were implemented and the data related to the implementation of those measures; and

**(h)** with respect to every effluent sample collected at each final discharge point, the annual mean concentration of mercury and selenium.

**e)** les résultats de la caractérisation de l'effluent, des essais de toxicité sublétale et du suivi de la qualité de l'eau;

**f)** les méthodes utilisées pour la caractérisation de l'effluent et le suivi de la qualité de l'eau, ainsi que les limites de détection de celles-ci;

**g)** la description des mesures d'assurance de la qualité et de contrôle de la qualité qui ont été prises ainsi que les données associées à leur mise en œuvre;

**h)** à l'égard de chaque échantillon d'effluent prélevé à tout point final de rejet, les concentrations moyennes annuelles de mercure et de sélénium.

**PART 2**

# Biological Monitoring Studies

## Required Studies

**9 (1)** Biological monitoring studies shall include

**(a)** a study respecting fish population, if the highest concentration of effluent in the exposure area, during a period in which there are deposits, is greater than 1% at any location that is 250 m from a point at which the effluent enters the area from a final discharge point, unless the results of the previous two biological monitoring studies indicate

**(i)** for all effect indicators with no assigned critical effect size, no effect on the fish population, and

**(ii)** for all effect indicators with an assigned critical effect size, no effect on the fish population or an effect on the fish population the absolute value of the magnitude of which is less than the absolute value of its assigned critical effect size;

**(b)** a study respecting the benthic invertebrate community, if the highest concentration of effluent in the exposure area, during a period in which there are deposits, is greater than 1% at any location that is 100 m from a point at which the effluent enters the area from a final discharge point, unless the results of the previous two biological monitoring studies indicate

**(i)** for all effect indicators with no assigned critical effect size, no effect on the benthic invertebrate community, and

**(ii)** for all effect indicators with an assigned critical effect size, no effect on the benthic invertebrate community or an effect on the benthic invertebrate community the absolute value of the magnitude of which is less than the absolute value of its assigned critical effect size;

**(c)** a study respecting fish tissue mercury, if

**PARTIE 2**

# Études de suivi biologique

## Composition des études

**9 (1)** Les études de suivi biologique comportent :

**a)** une étude sur la population de poissons, si la concentration de l'effluent la plus élevée dans une zone exposée, lors d'une période pendant laquelle il y a des rejets, est supérieure à 1 % à tout endroit situé à 250 m du point où l'effluent entre dans la zone depuis un point de rejet final, à moins que les résultats des deux études de suivi biologique précédentes révèlent, à la fois :

**(i)** à l'égard des indicateurs d'effet pour lesquels il n'y a pas de seuil critique d'effet, qu'il n'y a aucun effet sur la population de poissons,

**(ii)** à l'égard des indicateurs d'effet pour lesquels il y a un seuil critique d'effet, qu'il n'y a aucun effet sur la population de poissons ou qu'il y a un effet sur la population de poissons, dont la valeur absolue de l'ampleur est inférieure à la valeur absolue du seuil critique d'effet;

**b)** une étude sur la communauté d'invertébrés benthiques, si la concentration de l'effluent la plus élevée dans une zone exposée, lors d'une période pendant laquelle il y a des rejets, est supérieure à 1 % à tout endroit situé à 100 m d'un point où l'effluent entre dans la zone depuis un point de rejet final, sauf si les résultats des deux études de suivi biologique précédentes révèlent à la fois :

**(i)** à l'égard des indicateurs d'effet pour lesquels il n'y a pas de seuil critique d'effet, qu'il n'y a aucun effet sur la communauté d'invertébrés benthiques,

**(ii)** à l'égard des indicateurs pour lesquels il y a un seuil critique d'effet, qu'il n'y a aucun effet sur la communauté d'invertébrés benthiques ou il y a un effet sur la communauté d'invertébrés benthiques, dont la valeur absolue de l'ampleur est inférieure à la valeur absolue du seuil critique d'effet;

**(i)** effluent characterization reveals an annual mean concentration of total mercury in the effluent that is equal to or greater than 0.10 µg/L, based on a calendar year, unless the results of the previous two biological monitoring studies indicate no effect on fish tissue from mercury, or

**(ii)** the method detection limit used in respect of mercury for the analysis of at least two of four effluent samples in a calendar year is equal to or greater than 0.10 µg/L;

**(d)** a study respecting fish tissue selenium, if

**(i)** effluent characterization reveals a concentration of total selenium in the effluent that is equal to or greater than 10 µg/L,

**(ii)** effluent characterization reveals an annual mean concentration of total selenium in the effluent that is equal to or greater than 5 µg/L, based on a calendar year, or

**(iii)** the method detection limit used in respect of selenium for the analysis of any effluent sample is equal to or greater than 10 µg/L, or the method detection limit used in respect of selenium for the analysis of at least two of four effluent samples in a calendar year is equal to or greater than 5 µg/L; and

**(e)** if the cause of any effect on the fish population, on fish tissue from mercury or on the benthic invertebrate community is not known, a study that will be used to determine the cause of the effect if

**(i)** the results of the previous two biological monitoring studies indicate a similar type of effect, and

**(ii)** for an effect indicator with an assigned critical effect size, the absolute value of the magnitude of the effect is equal to or greater than the absolute value of its critical effect size in either of those studies.

**(2)** If the results of the previous two biological monitoring studies are used to lift the requirement to conduct a study under any of paragraphs (1)(a), (b), (c) or (e), the earlier of those two studies shall not be used to lift a requirement to conduct a subsequent study.

**(3)** For the purposes of subsection (1), the concentration of effluent shall be determined or the effluent characterization shall be carried out, as the case may be,

**(a)** in the case of the first biological monitoring studies, beginning on the day on which the mine becomes subject

**c)** une étude sur le mercure dans les tissus de poissons, si :

**(i)** soit la caractérisation de l'effluent révèle une concentration annuelle moyenne de mercure total égale ou supérieure à 0,10 µg/L pour une année civile donnée, sauf si les résultats des deux études de suivi biologique précédentes révèlent qu'il n'y a aucun effet du mercure sur les tissus de poissons,

**(ii)** soit la limite de détection de la méthode utilisée, à l'égard du mercure, pour l'analyse d'au moins deux échantillons d'effluent sur quatre pour une année civile donnée est égale ou supérieure à 0,10 µg/L;

**d)** une étude sur le sélénium dans les tissus de poissons, si :

**(i)** soit la caractérisation de l'effluent révèle une concentration de sélénium total égale ou supérieure à 10 µg/L,

**(ii)** soit la caractérisation de l'effluent révèle une concentration annuelle moyenne de sélénium total égale ou supérieure à 5 µg/L pour une année civile donnée,

**(iii)** soit la limite de détection de la méthode utilisée, à l'égard du sélénium, pour l'analyse de tout échantillon d'effluent est égale ou supérieure à 10 µg/L ou la limite de détection de la méthode utilisée, à l'égard du sélénium, pour l'analyse d'au moins deux échantillons d'effluent sur quatre pour une année civile donnée est égale ou supérieure à 5 µg/L;

**e)** si la cause d'un effet sur la population de poissons, d'un effet du mercure sur les tissus de poissons ou d'un effet sur la communauté d'invertébrés benthiques n'est pas connue, une étude qui sera utilisée pour établir la cause de l'effet si, à la fois :

**(i)** les résultats des deux études de suivi biologique précédentes indiquent un type d'effet semblable,

**(ii)** à l'égard de tout indicateur d'effet pour lequel un seuil critique d'effet est prévu, la valeur absolue de l'ampleur de l'effet est égale ou supérieure à la valeur absolue du seuil critique d'effet, dans l'une ou l'autre de ces deux études précédentes.

**(2)** Si les résultats des deux études de suivi biologique précédentes sont utilisés pour lever l'obligation de présenter une étude en application des alinéas (1)a), b), c) ou e), celle qui est antérieure à l'autre ne peut être utilisée pour lever l'obligation de présenter une étude subséquente.

**(3)** Pour l'application du paragraphe (1), la concentration de l'effluent est déterminée — et la caractérisation de l'effluent est effectuée — selon les périodes suivantes :

**a)** dans le cas des premières études de suivi biologique, à partir de la date à laquelle la mine est assujettie à l'article 7 du présent règlement et jusqu'au jour qui précède la date à laquelle le premier plan d'étude doit être présenté;

to section 7 of these Regulations and ending on the day before the day on which the first study design is required to be submitted; and

**(b)** for any subsequent biological monitoring studies, beginning on the day on which the previous study design was required to be submitted and ending on the day before the day on which the subsequent study design is required to be submitted.

**b)** pour les études de suivi biologique subséquentes, à partir de la date à laquelle le plan d'étude précédent devait être présenté et jusqu'au jour qui précède la date à laquelle le plan d'étude subséquent doit être présenté.

## DIVISION 1

# First Biological Monitoring Studies

## First Study Design

**10** A first study design shall be submitted to the Minister of the Environment not later than 12 months after the day on which a mine becomes subject to section 7 of these Regulations. It shall contain

**(a)** a site characterization that includes

**(i)** a description of the manner in which the effluent mixes within each exposure area, during a period in which there are deposits, including an estimate of the concentration of effluent in the exposure area at 100 m and 250 m from every point at which the effluent enters the area from a final discharge point and — in respect of each calendar year — any supporting data, including raw data, for the estimate,

**(ii)** a description of the exposure and reference areas where the biological monitoring studies would be conducted — whether or not they are required — that includes information on the geological, hydrological, oceanographical, limnological, chemical and biological features of those areas,

**(iii)** the type of production process used by the mine and the environmental protection practices in place at the mine,

**(iv)** a description of any anthropogenic, natural or other factors that are not related to the effluent but that may reasonably be expected to affect the results of any biological monitoring study, whether or not it is required, and

**(v)** any additional information that would enable a determination as to whether studies would be conducted in accordance with generally accepted standards of good scientific practice;

**(b)** a description of how any required study respecting fish population, fish tissue mercury and fish tissue selenium will be conducted that includes

**(i)** a description of and the scientific rationale for

## SECTION 1

# Premières études de suivi biologique

## Premier plan d'étude

**10** Un premier plan d'étude est présenté au ministre de l'Environnement au plus tard douze mois après la date à laquelle la mine devient assujettie à l'article 7 du présent règlement et comporte :

**a)** la caractérisation du site comportant :

**(i)** une description de la façon dont l'effluent se mélange dans chaque zone exposée, lors d'une période pendant laquelle il y a des rejets, notamment une estimation de la concentration de l'effluent à 100 m et à 250 m de chaque point où l'effluent entre dans la zone depuis un point de rejet final ainsi que, à l'égard de toute année civile, toute donnée justificative à l'appui de l'estimation, y compris les données brutes,

**(ii)** une description des zones exposées et des zones de référence, si une étude de suivi biologique serait menée, qu'elle soit exigée ou non, y compris les renseignements sur les caractéristiques géologiques, hydrologiques, océanographiques, limnologiques, chimiques et biologiques de ces zones,

**(iii)** le type de procédé de production utilisé par la mine et les pratiques de protection de l'environnement appliquées à la mine,

**(iv)** les facteurs anthropiques, naturels ou autres non liés à l'effluent, mais dont on peut raisonnablement s'attendre à ce qu'ils affectent les résultats de toute étude de suivi biologique, qu'elle soit exigée ou non,

**(v)** tout renseignement supplémentaire qui permet de déterminer si des études seraient effectuées conformément aux normes généralement reconnues régissant les bonnes pratiques scientifiques;

**b)** la description du déroulement de l'étude portant sur la population de poissons, sur le mercure dans les tissus de poissons ou sur le sélénium dans les tissus de poissons, si une telle étude est exigée :

**(i)** les éléments ci-après, y compris les motifs scientifiques à l'appui :

**(A)** the fish species selected, taking into account the abundance of the species most exposed to effluent,

**(B)** the sampling areas selected within the exposure area and the reference area,

**(C)** the sampling period selected,

**(D)** the sample size selected, and

**(E)** the field and laboratory methodologies selected, and

**(ii)** an explanation as to how, in the case of the study respecting fish population or fish tissue mercury, the study will provide the information necessary to determine if the effluent has an effect on fish population or on fish tissue from mercury;

**(c)** a description of how any required study respecting the benthic invertebrate community will be conducted that includes

**(i)** a description of and the scientific rationale for

**(A)** the sampling areas selected, taking into account the benthic invertebrate diversity and the area most exposed to effluent,

**(B)** the sampling period selected,

**(C)** the sample size selected, and

**(D)** the field and laboratory methodologies selected, and

**(ii)** an explanation as to how the study will provide the information necessary to determine if the effluent has an effect on the benthic invertebrate community;

**(d)** the month in which the samples will be collected for each required biological monitoring study;

**(e)** a description of the quality assurance and quality control measures that will be implemented for each required biological monitoring study to ensure the validity of the data that is collected; and

**(f)** a summary of the results of any studies to determine whether the effluent was causing an effect on the fish population, fish tissue from mercury or the benthic invertebrate community and of any studies in the exposure and reference areas respecting fish tissue selenium completed before the mine becomes subject to section 7 of these Regulations and any scientific data to support the results.

**(A)** les espèces de poissons choisies, compte tenu de l'abondance des espèces les plus exposées à l'effluent,

**(B)** les zones d'échantillonnage choisies de la zone exposée et de la zone de référence,

**(C)** la période d'échantillonnage choisie,

**(D)** la taille des échantillons choisie,

**(E)** les méthodes choisies sur le terrain et en laboratoire,

**(ii)** dans le cas de l'étude sur la population de poissons ou de l'étude sur le mercure dans les tissus de poissons, la façon dont l'étude fournira les renseignements permettant de déterminer si l'effluent a un effet sur la population de poissons ou un effet du mercure sur les tissus de poissons;

**c)** la description du déroulement de toute étude sur la communauté d'invertébrés benthiques exigée, notamment :

**(i)** une description des éléments ci-après, y compris les motifs scientifiques à l'appui :

**(A)** les zones d'échantillonnage choisies, compte tenu de la diversité des invertébrés benthiques et de la zone la plus exposée à l'effluent,

**(B)** la période d'échantillonnage choisie,

**(C)** la taille des échantillons choisie,

**(D)** les méthodes choisies sur le terrain et en laboratoire,

**(ii)** la façon dont l'étude fournira les renseignements permettant de déterminer si l'effluent a un effet sur la communauté d'invertébrés benthiques;

**d)** le mois pendant lequel les échantillons seront prélevés pour toute étude de suivi biologique exigée;

**e)** la description des mesures d'assurance de la qualité et de contrôle de la qualité pour toute étude de suivi biologique exigée qui seront prises pour garantir la validité des données recueillies;

**f)** un résumé des résultats de toute étude qui indique si l'effluent produit un effet sur les populations de poissons, un effet du mercure sur les tissus de poissons ou un effet sur la communauté d'invertébrés benthiques et de toute étude sur le sélénium dans les tissus de poissons dans la zone exposée et de référence, effectuées avant la date à laquelle la mine devient assujettie à l'article 7 du présent règlement, ainsi que toutes données scientifiques justificatives.

## First Biological Monitoring Studies

**11 (1)** Subject to subsection (2), the first biological monitoring studies shall start not earlier than six months after the day on which the first study design is submitted under section 10, and shall be conducted in accordance with that study design.

**(2)** If the owner or operator is unable to follow the study design due to circumstances beyond their control, the owner or operator shall inform the Minister of the Environment without delay of those circumstances and of the changes that are made to the study.

## First Interpretative Report

**12 (1)** A first interpretative report shall be submitted to the Minister of the Environment not later than 36 months after the day on which the mine becomes subject to section 7 of these Regulations. It shall contain

**(a)** a description of any deviation from the study design that occurred while the biological monitoring studies were being conducted and any impact that the deviation had on the studies;

**(b)** the latitude and longitude of sampling areas and a description of the sampling areas sufficient to identify the location of the sampling areas;

**(c)** the dates and times when samples were collected;

**(d)** the sample sizes;

**(e)** the mean, median, standard deviation, standard error and minimum and maximum values in the sampling areas for

**(i)** in the case of the study respecting fish population, effect indicators of growth, reproduction, condition and survival that include, if practicable, the length, total body weight and age of the fish, the weight of its liver or hepatopancreas and, if the fish are sexually mature, the egg weight, fecundity and gonad weight of the fish,

**(ii)** in the case of the study respecting the benthic invertebrate community, effect indicators of the total benthic invertebrate density, evenness index, taxa richness and, if the study is conducted in an area where it is possible to sample sediment, total organic carbon content of sediment and particle size distribution of sediment,

**(iii)** in the case of the study respecting fish tissue mercury, the effect indicator of the concentration of total mercury (wet weight) in the fish tissue, and

**(iv)** in the case of the study respecting fish tissue selenium, the concentration — in the muscle or whole body and, if practicable, in the ovaries or eggs — of total selenium (dry weight) reported in µg/g and the percentage of the moisture content of the sample;

## Premières études de suivi biologique

**11 (1)** Les premières études de suivi biologique débutent au plus tôt six mois après la date à laquelle le premier plan d'étude a été présenté en application de l'article 10 et sont effectuées conformément à ce plan.

**(2)** Toutefois, si le propriétaire ou l'exploitant est incapable de suivre le plan d'étude pour des raisons indépendantes de sa volonté, il en avise sans délai le ministre de l'Environnement et l'informe des modifications à apporter aux modalités du déroulement de l'étude.

## Premier rapport d'interprétation

**12 (1)** Un premier rapport d'interprétation est présenté au ministre de l'Environnement au plus tard trente-six mois après la date à laquelle la mine devient assujettie à l'article 7 du présent règlement et comporte :

**a)** la description de tout écart par rapport au plan d'étude qui s'est produit durant les études de suivi biologique et l'incidence de ces écarts sur les études;

**b)** la latitude et la longitude des zones d'échantillonnage et une description qui permet de reconnaître l'emplacement de ces zones;

**c)** les dates et heures de prélèvement des échantillons;

**d)** la taille des échantillons;

**e)** la moyenne, la médiane, l'écart-type, l'erreur-type ainsi que les valeurs minimales et maximales dans les zones d'échantillonnage quant aux éléments suivants :

**(i)** dans le cas de l'étude sur la population de poissons, les indicateurs d'effet qui portent sur la croissance des poissons, leur reproduction, leur condition et leur survie qui comprennent, dans la mesure du possible, la longueur, le poids corporel total, l'âge, le poids du foie ou de l'hépatopancréas et, si les poissons ont atteint la maturité sexuelle, le poids des œufs, le taux de fécondité et le poids des gonades,

**(ii)** dans le cas de l'étude sur la communauté d'invertébrés benthiques, les indicateurs d'effet qui portent sur la densité totale des invertébrés benthiques, l'indice de régularité, la richesse des taxons et, si des sédiments peuvent être prélevés à l'endroit où s'effectue l'étude, la teneur en carbone organique total des sédiments et la distribution granulométrique de ceux-ci,

**(iii)** dans le cas de l'étude sur le mercure dans les tissus de poissons, l'indicateur d'effet portant sur la concentration de mercure total (poids humide) dans les tissus,

**(iv)** dans le cas de l'étude sur le sélénium dans les tissus de poissons, la concentration — dans les muscles ou le corps et, dans la mesure du possible, les ovaires ou

**(f)** in the case of the study respecting the benthic invertebrate community, a calculation of the similarity index effect indicator;

**(g)** an identification of the sex of the fish sampled and of the presence of any lesions, tumours, parasites or other abnormalities and, in the case of the study respecting fish tissue selenium, the type of fish tissue studied and the scientific rationale for the selection of that tissue;

**(h)** a determination as to whether there is a statistically significant difference between the sampling areas for the calculations under subparagraphs (e)(i) to (iii) and paragraph (f) taking into consideration the information identified under paragraph (g), with the statistical comparison made separately and independently for each effect indicator;

**(i)** a statistical analysis of the results of the calculations under subparagraphs (e)(i) to (iii) and paragraph (g) that indicates the probability of correctly detecting an effect of a pre-defined size and the degree of confidence that can be placed in the calculations;

**(j)** for an effect indicator referred to in paragraph (e) with an assigned critical effect size, a comparison of the magnitude of the effect — calculated in accordance with subsection (2) or (3), as the case may be — to its critical effect size;

**(k)** any supporting data, including raw data, for the information provided under paragraphs (e) to (j);

**(l)** a description of any quality assurance or quality control measures that were implemented and the data related to the implementation of those measures;

**(m)** based on the information referred to in paragraphs (e) to (k), the identification of

**(i)** any effect on the fish population,

**(ii)** any effect on the benthic invertebrate community, and

**(iii)** any effect on fish tissue from mercury;

**(n)** for an effect indicator with an assigned critical effect size, a statement as to whether the absolute value of the magnitude of the effect is equal to or greater than the absolute value of its critical effect size;

**(o)** a summary of the results of effluent characterization, sublethal toxicity testing and water quality monitoring reported under paragraph 8(e) beginning on the day on which the mine becomes subject to section 7 of these Regulations;

**(p)** the conclusions of the biological monitoring studies, and a description of how those conclusions will impact the study design for subsequent biological monitoring studies, taking into account

les œufs — de sélénium total (poids sec), rapportée en µg/g, et le pourcentage d'humidité de l'échantillon;

**f)** dans le cas de l'étude sur la communauté d'invertébrés benthiques, le calcul de l'indicateur d'effet portant sur l'indice de similitude;

**g)** l'identification du sexe des poissons pris et la présence de lésions, de tumeurs, de parasites et d'autres anomalies et, dans le cas de l'étude sur le sélénium dans les tissus de poissons, le type de tissu étudié ainsi que les motifs scientifiques à l'appui du choix de tissu;

**h)** l'établissement à savoir s'il existe une différence statistique significative entre les zones d'échantillonnage pour les calculs effectués en application des sous-alinéas e)(i) à (iii) et de l'alinéa f) et eu égard aux renseignements visés à l'alinéa g), selon une comparaison statistique séparée et indépendante pour chaque indicateur d'effet;

**i)** une analyse statistique des résultats des calculs effectués en application des sous-alinéas e)(i) à (iii) et de l'alinéa g) qui indique la probabilité de détection correcte d'un effet d'une ampleur prédéterminée ainsi que le degré de confiance pouvant être accordé aux calculs;

**j)** une comparaison de l'ampleur de l'effet — calculée conformément aux paragraphes (2) ou (3) — par rapport au seuil critique d'effet d'un indicateur d'effet visé par l'alinéa e) et pour lequel il y a un seuil critique d'effet;

**k)** toute donnée justificative à l'appui, y compris les données brutes, relatives aux renseignements visés aux alinéas e) à j);

**l)** la description des mesures d'assurance de la qualité et de contrôle de la qualité qui ont été prises ainsi que les données associées à leur mise en œuvre;

**m)** selon les renseignements visés aux alinéas e) à k), l'indication de tout :

**(i)** effet sur la population de poissons,

**(ii)** effet sur la communauté d'invertébrés benthiques,

**(iii)** effet du mercure sur les tissus de poissons;

**n)** à l'égard de tout indicateur d'effet, un énoncé à savoir si la valeur absolue de l'ampleur de l'effet est égale ou supérieure à la valeur absolue du seuil critique d'effet prévu pour cet indicateur d'effet;

**o)** un résumé des résultats de la caractérisation de l'effluent, des essais de toxicité sublétale et du suivi de la qualité de l'eau visés à l'alinéa 8e) à partir de la date où la mine devient assujettie à l'article 7 du présent règlement;

**p)** les conclusions des études de suivi biologique et l'incidence de ces conclusions sur le plan d'étude pour les études de suivi biologique subséquentes, compte tenu des éléments suivants :

**(i)** les résultats de toute étude visée à l'alinéa 10f),

**(i)** the results of any studies referred to in paragraph 10(f),

**(ii)** the presence of anthropogenic, natural or other factors that are not related to the effluent under study and that may reasonably be expected to contribute to any observed effect,

**(iii)** the results of the statistical analysis conducted under paragraphs (h) and (i), and

**(iv)** the data referred to in paragraph (l);

**(q)** the month in which the next biological monitoring studies will start, if any biological monitoring studies are required; and

**(r)** the date when the next interpretative report is required to be submitted or would be required to be submitted but for the application of subsection 16(3).

**(2)** For the purpose of the study respecting fish population, the magnitude of the effect for an effect indicator is to be calculated using the following formula:

**(A – B)/B × 100**

where

**A** is

**(a)** for the purpose of the age indicator, the mean value for the indicator in the exposure area, and

**(b)** for the purpose of the indicators other than age, the adjusted mean value — obtained using the analysis of covariance (ANCOVA) statistical test method — for the indicator in the exposure area; and

**B** is

**(a)** for the purpose of the age indicator, the mean value for the indicator in the reference area, and

**(b)** for the purpose of the indicators other than age, the adjusted mean value — obtained using the analysis of covariance (ANCOVA) statistical test method — for the indicator in the reference area.

**(3)** For the purposes of the study respecting the benthic invertebrate community, the magnitude of the effect for an effect indicator is to be calculated using the following formula:

**(A – B)/C**

where

**A** is the mean value for the indicator in the exposure area;

**B** is the mean value for the indicator in the reference area; and

**C** is the standard deviation for the indicator in the reference area.

**(ii)** la présence de facteurs anthropiques, naturels ou autres non liés à l'effluent à l'étude et dont on peut raisonnablement s'attendre à ce qu'ils contribuent à tout effet observé,

**(iii)** les résultats de l'analyse statistique effectuée en application des alinéas h) et i),

**(iv)** les données visées à l'alinéa l);

**q)** le mois pendant lequel les prochaines études de suivi biologique débuteront, si des études de suivi biologique sont exigées;

**r)** la date à laquelle le prochain rapport d'interprétation doit être présenté ou devrait être présenté si ce n'était l'application du paragraphe 16(3).

**(2)** Pour l'étude sur la population de poissons, l'ampleur de l'effet d'un indicateur d'effet se calcule selon la formule suivante :

**(A – B)/B × 100**

où :

**A** représente :

**a)** dans le cas de l'âge, la moyenne pour l'indicateur dans la zone exposée;

**b)** dans le cas des autres indicateurs d'effet, la moyenne ajustée — obtenue en application de la méthode statistique de l'analyse de covariance (ANCOVA) — pour l'indicateur dans la zone exposée;

**B** selon le cas :

**a)** dans le cas de l'âge, la moyenne pour l'indicateur dans la zone de référence;

**b)** dans le cas des autres indicateurs d'effet, la moyenne ajustée — obtenue en application de la méthode statistique de l'analyse de covariance (ANCOVA) — pour l'indicateur dans la zone de référence.

**(3)** Pour l'étude sur la communauté d'invertébrés benthiques, l'ampleur de l'effet d'un indicateur se calcule selon la formule suivante :

**(A – B)/C**

où :

**A** représente la moyenne pour l'indicateur dans la zone exposée;

**B** la moyenne pour l'indicateur dans la zone de référence;

**C** l'écart-type pour l'indicateur dans la zone de référence.

**DIVISION 2**

# Subsequent Biological Monitoring Studies

## Subsequent Study Designs

**13 (1)** Each subsequent study design shall be submitted to the Minister of the Environment

**(a)** at least six months before the start of the biological monitoring studies that are set out in that study design; or

**(b)** if no biological monitoring studies are required, not later than 12 months after the day on which the previous interpretative report was required to be submitted or would have been required to be submitted but for the application of subsection 16(3).

**(2)** Each subsequent study design shall include

**(a)** a summary of the information referred to in paragraph 10(a) and a description of any changes to that information since the submission of the most recent study design, as well as — in respect of each calendar year — any supporting data, including raw data, for the estimate referred to in subparagraph 10(a)(i), whether or not the estimate has changed;

**(b)** the information referred to in paragraphs 10(b) to (e);

**(c)** a summary of the results of any biological monitoring studies conducted after June 6, 2002;

**(d)** if the study referred to in paragraph 9(1)(e) is required,

**(i)** the month in which the study will start, and

**(ii)** a description of how the study will be conducted that includes any field and laboratory methodologies that will be used to determine the cause of the effect; and

**(e)** if the cause of an effect on the fish population, on fish tissue from mercury or on the benthic invertebrate community is known, the cause of the effect and any supporting data, including raw data.

## Conduct of Subsequent Biological Monitoring Studies

**14 (1)** Subject to subsection (2), the subsequent biological monitoring studies shall be conducted in accordance with the study design submitted under section 13.

**(2)** If the owner or operator is unable to follow the study design due to circumstances beyond their control, the owner or

**SECTION 2**

# Études de suivi biologique subséquentes

## Plans d'étude subséquents

**13 (1)** Tout plan d'étude de suivi biologique subséquent est présenté au ministre de l'Environnement :

**a)** au moins six mois avant le début des études de suivi biologique visées dans ce plan d'étude;

**b)** si aucune étude de suivi biologique n'est exigée, au plus douze mois après la date à laquelle le rapport d'interprétation précédent devait être présenté ou aurait dû être présenté si ce n'était l'application du paragraphe 16(3).

**(2)** Tout plan d'étude de suivi biologique subséquent comporte :

**a)** un résumé des renseignements visés à l'alinéa 10a) et une description de toute modification à ces renseignements apportée depuis la présentation du dernier plan d'étude ainsi que, à l'égard de toute année civile, toute donnée justificative à l'appui de l'estimation visée au sous-alinéa 10a)(i), y compris les données brutes, que cette estimation ait changé ou non;

**b)** les renseignements visés aux alinéas 10b) à e);

**c)** un résumé des résultats de toute étude de suivi biologique effectuée depuis le 6 juin 2002;

**d)** si une étude visée à l'alinéa 9(1)e) est requise :

**(i)** le mois pendant lequel l'étude débutera,

**(ii)** une description de la façon dont l'étude sera effectuée, y compris toute méthode sur le terrain et en laboratoire, pour établir la cause de l'effet;

**e)** si la cause d'un effet sur la population de poissons, d'un effet du mercure sur les tissus de poissons ou d'un effet sur la communauté d'invertébrés benthiques est connue, la cause de l'effet ainsi que toute donnée justificative à l'appui, y compris les données brutes.

## Déroulement des études de suivi biologique subséquentes

**14 (1)** Toute étude de suivi biologique subséquente est effectuée conformément au plan d'étude présenté en application de l'article 13.

**(2)** Toutefois, si le propriétaire ou l'exploitant est incapable de suivre le plan d'étude pour des raisons indépendantes de

operator shall inform the Minister of the Environment without delay of those circumstances and the changes that are made to the study.

## Content of Subsequent Interpretative Reports

**15** Subject to subsection 16(3), each subsequent study design shall be followed by a subsequent interpretative report that includes

**(a)** for a study referred to in paragraphs 9(1)(a) to (d), the information referred to in paragraphs 12(1)(a) to (n) and (p) to (r);

**(b)** a summary of the results of effluent characterization, sublethal toxicity testing and water quality monitoring reported under paragraph 8(e) after the day on which the previous interpretative report was required to be submitted or would have been required to be submitted but for the application of subsection 16(3); and

**(c)** if the study design includes the description required under paragraph 13(2)(d),

**(i)** the cause of the effect, if determined, and any supporting data, including raw data, or

**(ii)** if the cause of the effect was not determined, an explanation of why and a description of any steps that need to be taken in the next study to determine that cause.

## Submission of Subsequent Interpretative Reports

**16 (1)** Subject to subsection (2), each subsequent interpretative report shall be submitted to the Minister of the Environment not later than 36 months after the day on which the previous interpretative report was required to be submitted or would have been required to be submitted but for the application of subsection 16(3).

**(2)** The interpretative report following a resumption of effluent discharge referred to in subsection 17(2) shall be submitted not later than 36 months after the day on which effluent discharge resumes.

**(3)** An interpretative report is not required in respect of a 36-month period if no biological monitoring studies are required in respect of that period.

## Cessation of Discharge

**17 (1)** The owner or operator of a mine that has ceased discharging effluent for a period of at least 36 months is not required to conduct environmental effects monitoring studies so long as the period of cessation continues.

sa volonté, il en avise sans délai le ministre de l'Environnement et l'informe des modifications à apporter aux modalités du déroulement de l'étude.

## Contenu des rapports d'interprétation subséquents

**15** Sous réserve du paragraphe 16(3), tout plan d'étude subséquent est suivi d'un rapport d'interprétation subséquent qui comporte :

**a)** dans le cas des études visées aux alinéas 9(1)a) à d), les renseignements visés aux alinéas 12(1)a) à n) et p) à r);

**b)** un résumé des résultats de la caractérisation de l'effluent, des essais de toxicité sublétale et du suivi de la qualité de l'eau visés à l'alinéa 8e) à partir de la date à laquelle le rapport d'interprétation précédent devait être présenté ou aurait dû être présenté si ce n'était l'application du paragraphe 16(3);

**c)** si le plan d'étude comprend une description exigée par l'alinéa 13(2)d) :

**(i)** la cause de l'effet, si elle a été déterminée, ainsi que toutes données justificatives à l'appui, y compris les données brutes,

**(ii)** si la cause n'a pas été déterminée, les raisons de l'échec ainsi que les mesures nécessaires pour déterminer cette cause lors de la prochaine étude.

## Présentation des rapports d'interprétation subséquents

**16 (1)** Tout rapport d'interprétation subséquent est présenté au ministre de l'Environnement au plus tard trente-six mois après la date à laquelle le rapport d'interprétation précédent devait être présenté ou aurait dû être présenté si ce n'était l'application du paragraphe 16(3).

**(2)** Toutefois, le rapport d'interprétation suivant la reprise du rejet d'effluents visée au paragraphe 17(2) est présenté au plus tard trente-six mois après la date de cette reprise.

**(3)** Aucun rapport d'interprétation n'est exigé à l'égard d'une période de trente-six mois à l'égard de laquelle aucune étude de suivi biologique n'est exigée.

## Cessation du rejet d'effluent

**17 (1)** Le propriétaire ou l'exploitant d'une mine dont les rejets d'effluent ont cessé pour une période d'au moins trente-six mois n'a pas l'obligation de mener des études de suivi des effets sur l'environnement tant que l'absence de rejets se poursuit.

**(2)** The requirement to conduct environmental effects monitoring studies shall resume, as the case may be, on

**(a)** the day on which effluent discharge resumes; or

**(b)** the day on which a notice referred to in paragraph 32(1)(a) of these Regulations is received by the Minister of the Environment.

**(3)** The owner or operator shall notify the Minister of the Environment in writing without delay

**(a)** when the period of cessation begins; and

**(b)** when the mine resumes effluent discharge.

**(4)** Any biological monitoring study that began before the end of the 36-month period shall be completed and followed by an interpretative report in accordance with section 15.

**(2)** L'obligation de mener des études de suivi des effets sur l'environnement reprend, selon le cas :

**a)** à la date de reprise du rejet d'effluents;

**b)** à la date à laquelle l'avis visé à l'alinéa 32(1)a) du présent règlement est reçu par le ministre de l'Environnement.

**(3)** Le propriétaire ou l'exploitant d'une mine avise le ministre de l'Environnement par écrit sans délai :

**a)** au début de la période d'absence de rejet d'effluents;

**b)** à la reprise du rejet d'effluents.

**(4)** Toute étude de suivi biologique débutée avant la fin de la période de trente-six mois est complétée et suivie d'un rapport d'interprétation conformément à l'article 15.

## DIVISION 3

# Final Studies

## General

**18 (1)** If an owner or operator of a mine has provided a notice referred to in paragraph 32(1)(a) of these Regulations to the Minister of the Environment, the owner or operator shall

**(a)** if the notice is received before biological monitoring studies have started, conduct the biological monitoring studies and submit any interpretative report that is required in respect of those studies; and

**(b)** if the notice is received after biological monitoring studies have started, in addition to submitting any interpretative report that is required in respect of those studies, submit a final study design in accordance with subsection (2), conduct final biological monitoring studies in accordance with section 19 and submit a final interpretative report in accordance with section 20.

**(2)** The final study design shall be submitted to the Minister of the Environment not later than six months after the day on which the notice referred to in paragraph 32(1)(a) of these Regulations is received. It shall include the information required under subsection 13(2).

## Conduct of Final Biological Monitoring Studies

**19 (1)** Subject to subsection (2), the final biological monitoring studies shall be conducted in accordance with the study design submitted under subsection 18(2) not earlier than six months after the day on which the final study design has been submitted.

## SECTION 3

# Études finales

## Généralités

**18 (1)** S'il a présenté au ministre de l'Environnement un avis visé à l'alinéa 32(1)a) du présent règlement, le propriétaire ou l'exploitant d'une mine :

**a)** dans le cas où l'avis est reçu avant le début des études de suivi biologique, effectue les études de suivi biologique et présente tout rapport d'interprétation requis à l'égard de ces études;

**b)** dans le cas où l'avis est reçu après le début des études de suivi biologique, en plus d'effectuer les études de suivi biologique et de présenter tout rapport d'interprétation exigé à l'égard de ces études, présente un plan d'étude final conformément au paragraphe (2), effectue une étude de suivi biologique finale conformément à l'article 19 et présente un rapport d'interprétation final conformément à l'article 20.

**(2)** Le plan d'étude final est présenté au ministre de l'Environnement au plus tard six mois après la date de réception de l'avis visé à l'alinéa 32(1)a) du présent règlement et comporte les renseignements exigés par le paragraphe 13(2).

## Déroulement des études de suivi biologique finales

**19 (1)** Les études de suivi biologique finales sont effectuées conformément au plan d'étude présenté en application du paragraphe 18(2), au plus tôt six mois après la date de présentation du plan d'étude final.

**(2)** If the owner or operator is unable to follow the study design due to circumstances beyond their control, the owner or operator shall inform the Minister of the Environment without delay of those circumstances and the changes that are made to the study.

## Content of Final Interpretative Report

**20** The final interpretative report shall be submitted to the Minister of the Environment not later than three years after the day on which the notice referred to in paragraph 32(1)(a) of these Regulations is received and shall include the information referred to in paragraphs 15(a) to (c).

SOR/2006-239, ss. 26 to 33, 34(F); SOR/2012-22, ss. 10 to 17; SOR/2018-99, s. 33.

**(2)** Toutefois, si le propriétaire ou l'exploitant est incapable de suivre le plan d'étude pour des raisons indépendantes de sa volonté, il en avise sans délai le ministre de l'Environnement et l'informe des modifications à apporter aux modalités du déroulement de l'étude.

## Contenu du rapport d'interprétation final

**20** Le rapport d'interprétation final est présenté au ministre de l'Environnement au plus tard trois ans après la date de réception de l'avis visé à l'alinéa 32(1)a) du présent règlement et comporte les renseignements visés aux alinéas 15a) à c).

DORS/2006-239, art. 26 à 33 et 34(F); DORS/2012-22, art. 10 à 17; DORS/2018-99, art. 33.

**SCHEDULE 6**

(Section 22)

# Annual Report Summarizing Effluent Monitoring Results

**PART 1**

## Identifying Information

**1** Name of the mine

**2** Address of the mine

**3** Name of the operator of the mine

**4** Operator's telephone number and e-mail address, if any

**5** Reporting period

**6** Date of report

**PART 2**

## Test Results Respecting Each Final Discharge Point

**1** Complete the following table with the monthly mean concentration for the deleterious substances set out in the table for each final discharge point and identify the location of the final discharge point.

**2** Any measurement not taken because there was no deposit from the final discharge point shall be identified by the letters "NDEP" (No Deposit).

**3** Any measurement not taken because no measurement was required in accordance with the conditions set out in section 12 or 13 of the *Metal Mining Effluent Regulations* shall be identified by the letters "NMR" (No Measurement Required).

**ANNEXE 6**

(article 22)

# Rapport annuel résumant les résultats du suivi de l'effluent

**PARTIE 1**

## Renseignements identificatoires

**1** Nom de la mine

**2** Adresse de la mine

**3** Nom de l'exploitant de la mine

**4** Numéro de téléphone de l'exploitant et adresse électronique, le cas échéant

**5** Période visée

**6** Date du rapport

**PARTIE 2**

## Résultats des essais à chacun des points de rejet final

**1** Remplir le tableau suivant pour chaque point de rejet final, identifier son emplacement et indiquer la moyenne mensuelle de la concentration des substances nocives.

**2** S'il n'y a pas eu de résultats parce qu'il n'y avait pas de rejet à partir du point de rejet final, inscrire « A.R. » (aucun rejet).

**3** S'il n'y a pas eu de mesure parce que l'article 12 ou 13 du *Règlement sur le effluents des mines de métaux* n'en exigeait aucune, inscrire « A.M.E. » (aucune mesure exigée).

| Location of final discharge point: | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | As (mg/L) | Cu (mg/L) | CN (mg/L) | Pb (mg/L) | Ni (mg/L) | Zn (mg/L) | TSS (mg/L) | Ra 226 (Bq/L) | Lowest pH | Highest pH | Effluent Volume ($m^3$) |
| Jan | | | | | | | | | | | |
| Feb | | | | | | | | | | | |
| Mar | | | | | | | | | | | |
| Apr | | | | | | | | | | | |
| May | | | | | | | | | | | |
| June | | | | | | | | | | | |
| July | | | | | | | | | | | |
| Aug | | | | | | | | | | | |
| Sept | | | | | | | | | | | |
| Oct | | | | | | | | | | | |
| Nov | | | | | | | | | | | |
| Dec | | | | | | | | | | | |

| Emplacement du point de rejet final : | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mois | As (mg/L) | Cu (mg/L) | CN (mg/L) | Pb (mg/L) | Ni (mg/L) | Zn (mg/L) | TSS (mg/L) | Ra 226 (Bq/L) | pH le plus bas | pH le plus haut | Volume d'effluent ($m^3$) |
| Janv | | | | | | | | | | | |
| Févr. | | | | | | | | | | | |
| Mars | | | | | | | | | | | |
| Avr | | | | | | | | | | | |
| Mai | | | | | | | | | | | |
| Juin | | | | | | | | | | | |
| Juill. | | | | | | | | | | | |
| Août | | | | | | | | | | | |
| Sept | | | | | | | | | | | |
| Oct | | | | | | | | | | | |
| Nov | | | | | | | | | | | |
| Déc | | | | | | | | | | | |

## PART 3

# Results of Acute Lethality Tests and *Daphnia Magna* Monitoring Tests

| Location of final discharge point: | | | |
|---|---|---|---|
| Date Sample Collected | Results for Rainbow Trout Acute Lethality Tests (mean percentage mortality in 100% effluent test concentration) | Results for *Daphnia magna* Monitoring Tests (mean percentage mortality in 100% effluent test concentration) | Results for Threespine Stickleback Acute Lethality Tests (mean percentage mortality in 100% effluent test concentration) |
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## PARTIE 3

# Résultats des essais de détermination de la létalité aiguë et des essais de suivi avec bioessais sur la *Daphnia magna*

| Emplacement du point de rejet final : | | | |
|---|---|---|---|
| Date du prélèvement de l'échantillon | Résultats des essais de détermination de la létalité aiguë sur la truite arc-en-ciel (pourcentage moyen de mortalité dans l'effluent non dilué) | Résultats des essais de suivi avec bioessais sur la *Daphnia magna* (pourcentage moyen de mortalité dans l'effluent non dilué) | Résultats des essais de détermination de la létalité aiguë sur l'épinoche à trois épines (pourcentage moyen de mortalité dans l'effluent non dilué) |
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## PART 4

[Repealed, SOR/2018-99, s. 34]

SOR/2006-239, s. 35; SOR/2018-99, s. 34.

## PARTIE 4

[Abrogée, DORS/2018-99, art. 34]

DORS/2006-239, art. 35; DORS/2018-99, art. 34.

## SCHEDULE 6.1
[Repealed, SOR/2018-99, s. 35]

## ANNEXE 6.1
[Abrogée, DORS/2018-99, art. 35]

## SCHEDULE 7
[Repealed, SOR/2018-99, s. 35]

## ANNEXE 7
[Abrogée, DORS/2018-99, art. 35]

## SCHEDULE 8
[Repealed, SOR/2018-99, s. 35]

## ANNEXE 8
[Abrogée, DORS/2018-99, art. 35]

# RELATED PROVISIONS

— SOR/2018-99, s. 37

**37 (1)** Despite subsection 8(1) of the *Metal and Diamond Mining Effluent Regulations*, the owner or operator of a mine that is subject to those Regulations on the day on which this section comes into force shall submit in writing to the Minister of the Environment the information referred to in paragraph 8(2)(c) of those Regulations not later than 60 days after the day on which this section comes into force.

**(2)** During the 12-month period beginning on the day on which this section comes into force, despite subsection 16(2) of the *Metal and Diamond Mining Effluent Regulations*, the owner or operator of a diamond mine may, for the purposes of determining whether effluent is acutely lethal for the 12-month period referred to in subsection 16(1) of those Regulations, use acute lethality data that was collected during any period of 12 consecutive months before the day on which this section comes into force, if the owner or operator submits a report to the Minister of the Environment that indicates that

**(a)** the tests to determine acute lethality have been conducted in accordance with the procedures set out in section 5 or 6 of Reference Method EPS 1/RM/10 or section 5 or 6 of Reference Method EPS 1/RM/13;

**(b)** the data relates to effluent generated after the start of commercial operation by the mine; and

**(c)** the data was collected not more than 36 months before the day on which this section comes into force.

**(3)** During the 12-month period beginning on the day on which section 14.3 of the *Metal and Diamond Mining Effluent Regulations* comes into force, despite subsection 16(2) of those Regulations, the owner or operator of a metal mine or diamond mine may, for the purposes of determining whether effluent is acutely lethal for the 12-month period referred to in subsection 16(1) of those Regulations, use acute lethality data that was collected during any period of 12 consecutive months before the day on which that section 14.3 comes into force, if the owner or operator submits a report to the Minister of the Environment that indicates that

**(a)** the tests to determine acute lethality have been conducted in accordance with the procedures set out in section 5 or 6 of Reference Method EPS 1/RM/14;

**(b)** the data relates to effluent generated after the start of commercial operation by the mine; and

**(c)** the data was collected not more than 36 months before the day on which that section 14.3 comes into force.

# DISPOSITIONS CONNEXES

— DORS/2018-99, art. 37

**37 (1)** Malgré le paragraphe 8(1) du *Règlement sur les effluents des mines de métaux et des mines de diamants*, le propriétaire ou l'exploitant d'une mine qui est assujettie à ce règlement, à la date d'entrée en vigueur du présent article, présente par écrit au ministre de l'Environnement les renseignements visés à l'alinéa 8(2)c) de ce règlement dans les soixante jours suivant la date d'entrée en vigueur du présent article.

**(2)** Pendant la période de douze mois commençant à la date d'entrée en vigueur du présent article, malgré le paragraphe 16(2) de ce règlement, le propriétaire ou l'exploitant d'une mine de diamants peut se fonder sur les données d'essai de détermination de la létalité aiguë recueillies pendant toute période de douze mois consécutifs précédant la date d'entrée en vigueur du présent article pour établir si l'effluent présente une létalité aiguë pendant la période de douze mois visée au paragraphe 16(1) de ce règlement, s'il présente au ministre de l'Environnement un rapport indiquant que :

**a)** les essais de détermination de la létalité aiguë ont été effectués conformément aux modes opératoires prévus aux sections 5 ou 6 de la méthode de référence SPE 1/RM/10 ou aux sections 5 ou 6 de la méthode de référence SPE 1/RM/13;

**b)** les données se rapportent à l'effluent émanant de la mine depuis le début de son exploitation commerciale;

**c)** les données ont été recueillies au cours des trente-six mois précédant la date d'entrée en vigueur du présent article.

**(3)** Pendant la période de douze mois commençant à la date d'entrée en vigueur de l'article 14.3 de ce règlement, malgré le paragraphe 16(2) de ce règlement, le propriétaire ou l'exploitant d'une mine de métal ou d'une mine de diamants peut se fonder sur les données d'essai de détermination de la létalité aiguë recueillies pendant toute période de douze mois consécutifs précédant la date d'entrée en vigueur de l'article 14.3 de ce règlement pour établir si l'effluent présente une létalité aiguë pendant la période de douze mois visée au paragraphe 16(1) de ce règlement, s'il présente au ministre de l'Environnement un rapport indiquant que :

**a)** les essais de détermination de la létalité aiguë ont été effectués conformément aux modes opératoires prévus aux sections 5 ou 6 de la méthode de référence SPE 1/RM/14;

**b)** les données se rapportent à l'effluent émanant de la mine depuis le début de son exploitation commerciale;

**c)** les données ont été recueillies au cours des trente-six mois précédant l'entrée en vigueur de l'article 14.3 de ce règlement.

— SOR/2018-99, s. 38

**38 (1)** Despite section 10 of Schedule 5 to the *Metal and Diamond Mining Effluent Regulations*, the first study design of a diamond mine that is subject to those Regulations on June 1, 2018 may be submitted not later than the earlier of June 1, 2021 and the day on which a document that is equivalent to a study design is required to be submitted under provincial or territorial laws.

**(2)** In the case of a diamond mine in respect of which the first study design is submitted under subsection (1), the period referred to in subsection 11(1) of Schedule 5 to the *Metal and Diamond Mining Effluent Regulations* does not apply.

**(3)** In the case of a diamond mine that is subject to the *Metal and Diamond Mining Effluent Regulations* on June 1, 2018, the results of any studies conducted before the day on which the first study design is submitted may be used for the purpose of determining which biological monitoring studies are required to be conducted under section 9 of Schedule 5 to those Regulations if those results can be used for the purpose of meeting the requirements of section 12 of that Schedule.

**(4)** However, only information gathered — for the purpose of meeting the requirements of provincial or territorial laws — during the three-year period before the day on which the first study design is submitted may be used to determine the concentration of effluent, mercury and selenium for the application of subsections 9(1) and (2) of Schedule 5 to the *Metal and Diamond Mining Effluent Regulations*. If that information is used, paragraph 9(3)(a) of that Schedule does not apply.

**(5)** If the results of studies referred to in subsection (3) and the information referred to in subsection (4) are used in accordance with those subsections, the first study design shall include, in addition to the information referred to in section 10 of Schedule 5 to the *Metal and Diamond Mining Effluent Regulations*, the information referred to in paragraph 13(2)(d) or (e), as the case may be, of that Schedule, copies of and a summary of the results of the studies and an explanation — that includes supporting information — as to how the results and information can be used for the purposes of meeting the requirements of sections 9 and 12 of that Schedule.

**(6)** In the case of a diamond mine that is subject to the *Metal and Diamond Mining Effluent Regulations* on June 1, 2018, the effluent and water quality monitoring studies set out in Part 1 of Schedule 5 to those Regulations shall be started on the day on which the first study design is submitted.

**(7)** In the case of a diamond mine that is subject to the *Metal and Diamond Mining Effluent Regulations* on June 1, 2018, the results of sublethal toxicity tests conducted — for the purpose of meeting the requirements of provincial or territorial laws — during the three-year period before the day on which the first study design is submitted may be used for the application of subsection 6(3) of Schedule 5 to those Regulations, as if three years had elapsed, if those tests meet the requirements of subsection 5(1) of that Schedule. If those results are used, subsections 6(1) and (2) of that Schedule do not apply.

— DORS/2018-99, art. 38

**38 (1)** Malgré l'article 10 de l'annexe 5 du *Règlement sur les effluents des mines de métaux et des mines de diamants*, le premier plan d'étude concernant une mine de diamants assujettie à ce règlement le 1er juin 2018 peut être présenté, au plus tard, le 1er juin 2021 ou, si elle est antérieure, à la date à laquelle un document équivalent à un plan d'étude doit être présenté aux termes de règles de droit provinciales ou territoriales.

**(2)** Dans le cas d'une mine de diamants à l'égard de laquelle le premier plan d'étude est présenté en application du paragraphe (1), la période visée au paragraphe 11(1) de cette annexe ne s'applique pas.

**(3)** Dans le cas d'une mine de diamants assujettie à ce règlement le 1er juin 2018, les résultats d'études effectuées avant la date à laquelle le premier plan d'étude est présenté peuvent être utilisés pour déterminer quelles études de suivi biologique doivent être effectuées en application de l'article 9 de cette annexe, à condition que ces résultats puissent être utilisés pour satisfaire aux exigences prévues à l'article 12 de cette annexe.

**(4)** Toutefois, seuls les renseignements recueillis — pour satisfaire aux règles de droit provinciales ou territoriales — dans les trois ans qui précèdent la date de présentation du premier plan d'étude peuvent être utilisés pour déterminer la concentration de l'effluent, de mercure et de sélénium pour l'application des paragraphes 9(1) et (2) de cette annexe. Si ces renseignements sont utilisés, l'alinéa 9(3)a) de cette annexe ne s'applique pas.

**(5)** Si les résultats d'études visés au paragraphe (3) et les renseignements visés au paragraphe (4) sont utilisés conformément à ces paragraphes, le premier plan d'étude comprend, en plus des renseignements visés à l'article 10 de cette annexe, les renseignements visés, selon le cas, à l'alinéa 13(2)d) ou e) de cette annexe, des copies et un résumé des résultats des études et une explication — y compris les renseignements à l'appui — quant à la manière dont les résultats et les renseignements peuvent être utilisées pour satisfaire aux exigences des articles 9 et 12 de cette annexe.

**(6)** Dans le cas d'une mine de diamants assujettie à ce règlement le 1er juin 2018, les études de suivi de l'effluent et de la qualité de l'eau prévues à la partie 1 de cette annexe débutent à la date de présentation du premier plan d'étude.

**(7)** Dans le cas d'une mine de diamants assujettie à ce règlement le 1er juin 2018, les résultats d'essais de toxicité sublétale effectués — pour satisfaire aux règles de droit provinciales ou territoriales — dans les trois ans qui précèdent la date de présentation du premier plan d'étude peuvent être utilisés pour l'application du paragraphe 6(3) de cette annexe, comme s'il s'était écoulé trois ans, si ces essais satisfont aux exigences du paragraphe 5(1) de cette annexe. Si ces résultats sont utilisés, les paragraphes 6(1) et (2) de cette annexe ne s'appliquent pas.

**(8)** If the results of sublethal toxicity tests are used in accordance with subsection (7), the information referred to in paragraphs 8(a), (c), (e) and (g) of Schedule 5 to the *Metal and Diamond Mining Effluent Regulations*, in relation to those tests, shall be submitted to the Minister of the Environment not later than the day on which the first study design is submitted and shall be accompanied by a summary of the results of the tests and an explanation — that includes supporting information — as to how the results can be used for the purposes of meeting the requirements of subsection 5(1) of that Schedule.

**(9)** In the case of a diamond mine that is subject to the *Metal and Diamond Mining Effluent Regulations* on June 1, 2018, the first interpretative report shall, despite subsection 12(1) of Schedule 5 to those Regulations, be submitted not later than 24 months after the day on which the first study design is submitted and shall contain, in addition to the information referred to in section 12 of that Schedule, the information referred to in paragraph 15(c) of that Schedule.

— SOR/2018-99, s. 39

**39** In the case of a metal mine that is subject to the *Metal and Diamond Mining Effluent Regulations* on June 1, 2018,

**(a)** sections 4 to 8 of Schedule 5 to those Regulations apply beginning on January 1, 2019 and, until that day, the *Metal Mining Effluent Regulations*, as they read immediately before June 1, 2018, continue to apply to the matters referred to in those sections;

**(b)** subsections 6(1) and (2) of Schedule 5 to those Regulations do not apply and the results of sublethal toxicity tests conducted under the *Metal Mining Effluent Regulations* during the three-year period before January 1, 2019 shall be used for the application of subsection 6(3) of that Schedule, as if three years had elapsed; and

**(c)** biological monitoring studies started on or before June 1, 2018 shall be completed, and the corresponding interpretative report shall be submitted, in accordance with the *Metal Mining Effluent Regulations*, as they read immediately before June 1, 2018.

**(8)** Si les résultats d'essais de toxicité sublétale sont utilisés conformément au paragraphe (7), les renseignements relatifs à ces essais visés aux alinéas 8a), c), e) et g) de cette annexe sont présentés au ministre de l'Environnement au plus tard à la date de présentation du premier plan d'étude et ils sont accompagnés d'un résumé des résultats des essais ainsi qu'une explication — y compris les renseignements à l'appui — quant à la manière dont les résultats peuvent être utilisées pour satisfaire aux exigences du paragraphe 5(1) de cette annexe.

**(9)** Dans le cas d'une mine de diamants assujettie à ce règlement le 1er juin 2018, le premier rapport d'interprétation est présenté, malgré le paragraphe 12(1) de cette annexe, au plus tard vingt-quatre mois après la date de présentation du premier plan d'étude et il comprend, en plus des renseignements visés à l'article 12 de cette annexe, les renseignements visés à l'alinéa 15c) de l'annexe.

— DORS/2018-99, art. 39

**39** Dans le cas d'une mine de métaux assujettie au *Règlement sur les effluents des mines de métaux et des mines de diamants* le 1er juin 2018 :

**a)** les articles 4 à 8 de l'annexe 5 de ce règlement s'appliquent à partir du 1er janvier 2019 et, jusqu'à cette date, les dispositions du *Règlement sur les effluents des mines de métaux*, dans leur version antérieure au 1er juin 2018, continuent de régir les matières visées par ces articles;

**b)** les paragraphes 6(1) et (2) de cette annexe ne s'appliquent pas et les résultats des essais de toxicité sublétale effectués au titre du *Règlement sur les effluents des mines de métaux* dans les trois années qui précèdent le 1er janvier 2019 sont utilisés pour l'application du paragraphe 6(3) de cette annexe, comme s'il s'était écoulé trois ans;

**c)** les études de suivi biologique débutées le 1er juin 2018 ou avant cette date sont menées à terme conformément aux dispositions du *Règlement sur les effluents des mines de métaux*, dans leur version antérieure au 1er juin 2018, et le rapport d'interprétation qui s'y rapporte est présenté selon les modalités prévues à cette version du même règlement.

# AMENDMENTS NOT IN FORCE

— SOR/2018-99, s. 2(4)

**2 (4) The definition *acutely lethal* in subsection 1(1) of the Regulations is amended by striking out "or" at the end of paragraph (a), by adding "or" at the end of paragraph (b) and by adding the following after paragraph (b):**

**(c)** more than 50% of the *Daphnia magna* subjected to it for a period of 48 hours, when tested in accordance with the acute lethality test set out in section 14.3.

— SOR/2018-99, s. 2(6)

**2 (6) Section 1 of the Regulations is amended by adding the following after subsection (1):**

**(2)** Every reference in these Regulations to column 1, 2, 3 or 4 of Schedule 4 shall be read as

**(a)** a reference to column 1, 2, 3 or 4 of Table 1 of Schedule 4, in the case of a mine to which subparagraph 4(1)(a)(i) applies; or

**(b)** a reference to column 1, 2, 3 or 4 of Table 2 of Schedule 4, in the case of a mine to which subparagraph 4(1)(a)(ii) applies.

— SOR/2018-99, ss. 3(2), (3)

**3 (2) Section 3 of the Regulations is amended by striking out "and" at the end of paragraph (g), by adding "and" at the end of paragraph (h) and by adding the following after paragraph (h):**

**(i)** un-ionized ammonia.

**(3) Paragraph 4(1)(a) of the Regulations is replaced by the following:**

**(a)** the concentration of the deleterious substance in the effluent does not exceed the maximum authorized concentrations that are set out in columns 2, 3 and 4 of

**(i)** Table 1 of Schedule 4, in the case of a mine in respect of which these Regulations apply for the first time on or after June 1, 2021 or in the case of a recognized closed mine that returns to commercial operation on or after June 1, 2021, or

**(ii)** Table 2 of Schedule 4, in any other case;

— SOR/2018-99, s. 4

**4 The Regulations are amended by adding the following after section 4:**

# MODIFICATIONS NON EN VIGUEUR

— DORS/2018-99, par. 2(4)

**2 (4) La définition de *létalité aiguë*, au paragraphe 1(1) du même règlement, est modifiée par adjonction, après l'alinéa b), de ce qui suit :**

**c)** plus de 50 % des *Daphnia magna* qui y sont exposées pendant une période de quarante-huit heures au cours de l'essai de détermination de la létalité aiguë visé à l'article 14.3.

— DORS/2018-99, par. 2(6)

**2 (6) L'article 1 du même règlement est modifié par adjonction, après le paragraphe (1), de ce qui suit :**

**(2)** Tout renvoi à la colonne 1, 2, 3 ou 4 de l'annexe 4 dans le présent règlement constitue un renvoi :

**a)** dans le cas d'une mine à laquelle s'applique le sous-alinéa 4(1)a)(i), à la colonne 1, 2, 3 ou 4 du tableau 1 de l'annexe 4;

**b)** dans le cas d'une mine à laquelle s'applique le sous-alinéa 4(1)a)(ii), à la colonne 1, 2, 3 ou 4 du tableau 2 de l'annexe 4.

— DORS/2018-99, par. 3(2) et (3)

**3 (2) L'article 3 du même règlement est modifié par adjonction, après l'alinéa h), de ce qui suit :**

**i)** l'ammoniac non ionisé.

**(3) L'alinéa 4(1)a) du même règlement est remplacé par ce qui suit :**

**a)** la concentration de la substance nocive dans l'effluent ne dépasse pas les concentrations maximales permises qui sont établies aux colonnes 2, 3 et 4 :

**(i)** du tableau 1 de l'annexe 4, dans le cas d'une mine à l'égard de laquelle le présent règlement s'applique pour la première fois le 1er juin 2021 ou après cette date ou d'une une mine reconnue fermée dont l'exploitation commerciale a repris le 1er juin 2021 ou après cette date,

**(ii)** du tableau 2 de l'annexe 4, dans tous les autres cas;

— DORS/2018-99, art. 4

**4 Le même règlement est modifié par adjonction, après l'article 4, de ce qui suit :**

**4.1** Paragraph 4(1)(c) does not apply in the case where the effluent is determined to be acutely lethal in accordance with the procedures set out in section 5 or 6 of Reference Method EPS 1/RM/14 when the owner or operator of a mine is testing at the frequency prescribed in subsection 14(1), unless the effluent is determined to be acutely lethal in accordance with any other acute lethality test.

— SOR/2018-99, ss. 9(2) to (4)

**9 (2) Subsection 12(1) of the Regulations is replaced by the following:**

**12 (1)** The owner or operator of a mine shall, not less than once per week and at least 24 hours apart, collect from each final discharge point

**(a)** a grab sample or composite sample of effluent and record the pH of the sample at the time of its collection and record, without delay after collecting the sample, the concentrations of the deleterious substances prescribed in section 3 except un-ionized ammonia; and

**(b)** a grab sample of effluent and record the temperature and the pH of the sample at the time of its collection and record, without delay after collecting the sample, the concentrations of total ammonia expressed as nitrogen (N).

**(3) Section 12 of the Regulations is amended by adding the following after subsection (3):**

**(4)** The owner or operator of a mine shall determine and record the concentration of un-ionized ammonia, using the temperature, pH and concentration of total ammonia recorded under paragraph (1)(b), in accordance with the following formula:

$$A\ (1/(1 + 10^{pKa-pH}))$$

where

**A** is the concentration of total ammonia — which is the sum of un-ionized ammonia ($NH_3$) and ionized ammonia ($NH_4^+$) — expressed in mg/L as nitrogen (N);

**pH** is the pH of the effluent sample; and

**pKa** is a dissociation constant calculated in accordance with the following formula:

$$0.09018 + 2729.92/T$$

where

**T** is the temperature of the effluent sample in kelvin.

**(4) Subsection 13(1) of the Regulations is replaced by the following:**

**13 (1)** The owner or operator of a mine may reduce the frequency of conducting tests relating to the concentrations of arsenic, copper, cyanide, lead, nickel, zinc or un-ionized ammonia at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one

**4.1** L'alinéa 4(1)c) ne s'applique pas s'il est déterminé que l'effluent présente une létalité aiguë conformément aux modes opératoires visés aux sections 5 ou 6 de la méthode de référence SPE 1/RM/14, lorsque le propriétaire ou l'exploitant d'une mine effectue l'essai à la fréquence prévue au paragraphe 14(1) à moins qu'un autre essai de détermination de la létalité aiguë indique que l'effluent présente une létalité aiguë.

— DORS/2018-99, par. 9(2) à (4)

**9 (2) Le paragraphe 12(1) du même règlement est remplacé par ce qui suit :**

**12 (1)** Au moins une fois par semaine et à au moins vingt-quatre heures d'intervalle, le propriétaire ou l'exploitant d'une mine prélève, à partir de chaque point de rejet final :

**a)** un échantillon instantané ou un échantillon composite d'effluent dont il enregistre le pH au moment du prélèvement, ainsi que, sans délai après celui-ci, les concentrations des substances nocives désignées à l'article 3, à l'exception de l'ammoniac non ionisé;

**b)** un échantillon instantané d'effluent dont il enregistre la température et le pH au moment du prélèvement, ainsi que, sans délai après celui-ci, la concentration d'ammoniac total sous forme d'azote (N).

**(3) L'article 12 du même règlement est modifié par adjonction, après le paragraphe (3), de ce qui suit :**

**(4)** Le propriétaire ou l'exploitant d'une mine calcule et enregistre la concentration d'ammoniac non ionisé selon la formule ci-après, en utilisant la température, le pH et la concentration d'ammoniac total enregistré en application de l'alinéa (1)b) :

$$A\ (1/(1 + 10^{pKa-pH}))$$

où :

**A** représente la concentration d'ammoniac total — soit l'ammoniac non ionisé ($NH_3$) et l'ammoniac ionisé ($NH_4^+$) — exprimée en mg/L et sous forme d'azote (N);

**pH** le pH de l'échantillon d'effluent;

**pKa** la constante de dissociation calculée selon la formule suivante :

$$0,09018 + 2729,92/T$$

où :

**T** représente la température de l'échantillon d'effluent en kelvin.

**(4) Le paragraphe 13(1) du même règlement est remplacé par ce qui suit :**

**13 (1)** Le propriétaire ou l'exploitant d'une mine peut, à un point de rejet final, réduire la fréquence des essais concernant la concentration d'arsenic, de cuivre, de cyanure, de plomb, de nickel, de zinc ou d'ammoniac non ionisé à au moins une fois par trimestre civil, chaque essai étant effectué à au moins

month apart, if that substance's monthly mean concentration at that final discharge point is less than 10% of the value set out in column 2 of Schedule 4 for 12 consecutive months.

— SOR/2018-99, ss. 10(2), (3)

**10 (2) Subsection 14(1) of the Regulations is replaced by the following:**

**14 (1)** Subject to section 15, the owner or operator of a mine shall collect, once a month, a grab sample of effluent from each final discharge point and determine whether the effluent is acutely lethal by conducting acute lethality tests on aliquots of each effluent sample in accordance with sections 14.1 to 14.3.

**(3) Subsection 14(3) of the Regulations is replaced by the following:**

**(3)** When collecting a grab sample of effluent for the purposes of subsection (1), the owner or operator of a mine shall

**(a)** collect a sufficient volume of effluent to enable the owner or operator to comply with paragraph 15(1)(a); and

**(b)** record the temperature and the pH of each grab sample of effluent at the time of the sample's collection.

— SOR/2018-99, s. 11

**11 The Regulations are amended by adding the following after section 14.2:**

Acute Lethality Test — *Daphnia Magna*

**14.3** Unless the salinity value of the effluent is equal to or greater than four parts per thousand and the effluent is deposited into marine waters, the owner or operator of a mine shall, in addition to conducting the acute lethality test set out in section 14.1, determine whether the effluent is acutely lethal by conducting an acute lethality test in accordance with the procedures set out in section 5 or 6 of Reference Method EPS 1/RM/14.

— SOR/2018-99, s. 12(2)

**12 (2) Paragraphs 15(1)(a) and (b) of the Regulations are replaced by the following:**

**(a)** without delay,

**(i)** conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample collected under subsection 14(1),

**(ii)** record the concentration of total ammonia and, using that concentration and using the temperature and pH recorded under paragraph 14(3)(b), determine the

un mois d'intervalle, si la concentration moyenne mensuelle de la substance à ce point de rejet final est inférieure à 10 % de la valeur établie à la colonne 2 de l'annexe 4 pendant douze mois consécutifs.

— DORS/2018-99, par. 10(2) et (3)

**10 (2) Le paragraphe 14(1) du même règlement est remplacé par ce qui suit :**

**14 (1)** Sous réserve de l'article 15, le propriétaire ou l'exploitant d'une mine prélève une fois par mois un échantillon instantané d'effluent à chaque point de rejet final et détermine si cet effluent présente une létalité aiguë en effectuant des essais de détermination de la létalité aiguë sur des portions aliquotes de chaque échantillon conformément aux articles 14.1 à 14.3.

**(3) Le paragraphe 14(3) du même règlement est remplacé par ce qui suit :**

**(3)** Lors du prélèvement des échantillons instantanés en application du paragraphe (1), le propriétaire ou l'exploitant d'une mine :

**a)** prélève un volume d'effluent suffisant pour lui permettre de se conformer à l'alinéa 15(1)a);

**b)** enregistre, au moment du prélèvement, la température et le pH de chaque échantillon.

— DORS/2018-99, art. 11

**11 Le même règlement est modifié par adjonction, après l'article 14.2, de ce qui suit :**

Essai de détermination de la létalité aiguë — *Daphnia magna*

**14.3** Sauf dans le cas où la salinité de l'effluent est égale ou supérieure à quatre parties par millier et que l'effluent est rejeté dans l'eau de mer, le propriétaire ou l'exploitant d'une mine détermine si l'effluent présente une létalité aiguë en effectuant, en plus de l'essai de détermination de la létalité aiguë prévu à l'article 14.1, un essai de détermination de la létalité aiguë conformément aux modes opératoires prévus aux sections 5 ou 6 de la méthode de référence SPE 1/RM/14.

— DORS/2018-99, par. 12(2)

**12 (2) Les alinéas 15(1)a) et b) du même règlement sont remplacés par ce qui suit :**

**a)** sans délai :

**(i)** effectue la caractérisation de l'effluent conformément au paragraphe 4(1) de l'annexe 5 sur une portion aliquote de chaque échantillon instantané prélevé en application du paragraphe 14(1),

**(ii)** enregistre la concentration d'ammoniac total et, au moyen de cette concentration et de la température et du

concentration of un-ionized ammonia in accordance with the formula set out in subsection 12(4), and

**(iii)** record the concentrations of the deleterious substances prescribed in section 3;

**(b)** collect a grab sample twice a month from the final discharge point from which the effluent sample determined to be acutely lethal was collected, record the temperature and the pH of each sample at the time of its collection and, without delay, conduct the acute lethality test that determined the effluent sample to be acutely lethal on each grab sample in accordance with the procedure set out in section 6 of the applicable reference method and, if the sample is determined to be acutely lethal, without delay,

**(i)** conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample,

**(ii)** record the concentration of total ammonia and, using that concentration and using the temperature and pH recorded under this paragraph, determine the concentration of un-ionized ammonia in accordance with the formula set out in subsection 12(4), and

**(iii)** record the concentrations of the deleterious substances prescribed in section 3; and

pH enregistrés en application de l'alinéa 14(3)b), calcule la concentration d'ammoniac non ionisé selon la formule prévue au paragraphe 12(4),

**(iii)** enregistre les concentrations des substances nocives désignées à l'article 3;

**b)** deux fois par mois, prélève un échantillon instantané à partir du point de rejet final d'où l'échantillon d'effluent qui présente une létalité aiguë a été prélevé, enregistre, au moment du prélèvement, la température et le pH de chaque échantillon, et effectue sans délai après le prélèvement, sur chacun de ces échantillons, selon le mode opératoire prévu à la section 6 de la méthode de référence, l'essai de détermination de la létalité aiguë à partir duquel la létalité aiguë de l'échantillon a été établie. S'il est ainsi établi que l'échantillon présente une létalité aiguë, le propriétaire ou l'exploitant d'une mine, sans délai :

**(i)** effectue la caractérisation de l'effluent conformément au paragraphe 4(1) de l'annexe 5 sur une portion aliquote de chaque échantillon instantané,

**(ii)** enregistre la concentration d'ammoniac total et, au moyen de cette concentration et de la température et du pH enregistrés en application du présent alinéa, calcule la concentration d'ammoniac non ionisé selon la formule prévue au paragraphe 12(4),

**(iii)** enregistre les concentrations des substances nocives désignées à l'article 3;

— SOR/2018-99, s. 13

**13 The Regulations are amended by adding the following after section 15:**

**15.1** Despite paragraph 15(1)(c), if an effluent sample is determined to be acutely lethal when tested using the acute lethality test set out in section 14.3, the owner or operator of a mine shall, without delay, collect the first grab sample required by paragraph 15(1)(b) and comply with the requirements of that paragraph.

— DORS/2018-99, art. 13

**13 Le même règlement est modifié par adjonction, après l'article 15, de ce qui suit :**

**15.1** Malgré l'alinéa 15(1)c), s'il est établi qu'un échantillon d'effluent présente une létalité aiguë après l'essai de détermination de la létalité aiguë prévu à l'article 14.3, le propriétaire ou l'exploitant d'une mine prélève sans délai le premier échantillon instantané exigé par l'alinéa 15(1)b) et se conforme aux exigences de cet alinéa.

— SOR/2018-99, s. 15(2)

**15 (2) Section 17 of the Regulations and the heading before it are repealed.**

— DORS/2018-99, par. 15(2)

**15 (2) L'article 17 du même règlement et l'intertitre le précédant sont abrogés.**

— SOR/2018-99, s. 16(2)

**16 (2) Section 18 of the Regulations is replaced by the following:**

**18** The owner or operator of a mine shall record without delay the data referred to in section 9.1 of Reference Method EPS 1/RM/10, section 8.1 of Reference Method EPS 1/RM/13 and section 8.1 of Reference Method EPS 1/RM/14 for all acute lethality tests that are conducted to monitor deposits from final discharge points.

— DORS/2018-99, par. 16(2)

**16 (2) L'article 18 du même règlement est remplacé par ce qui suit :**

**18** Le propriétaire ou l'exploitant d'une mine enregistre sans délai les données visées à la section 9.1 de la méthode de référence SPE 1/RM/10, à la section 8.1 de la méthode de référence SPE 1/RM/13 et à la section 8.1 de la méthode de référence SPE 1/RM/14 pour tous les essais de détermination de la létalité aiguë effectués dans le cadre du suivi des rejets provenant de points de rejet final.

— SOR/2018-99, s. 18(2)

**18 (2) Paragraph 19.1(1)(a) of the Regulations is replaced by the following:**

**(a)** in mg/L for deleterious substances referred to in paragraphs 3(a) to (g) and (i); and

— DORS/2018-99, par. 18(2)

**18 (2) L'alinéa 19.1(1)a) du même règlement est remplacé par ce qui suit :**

**a)** la concentration moyenne mensuelle en mg/L des substances nocives énumérées aux alinéas 3a) à g) et i);

— SOR/2018-99, s. 19(2)

**19 (2) Paragraph 20(1)(a) of the Regulations is replaced by the following:**

**(a)** in kg for deleterious substances referred to paragraphs 3(a) to (g) and (i); and

— DORS/2018-99, par. 19(2)

**19 (2) L'alinéa 20(1)a) du même règlement est remplacé par ce qui suit :**

**a)** la charge en kg des substances nocives énumérées aux alinéas 3a) à g) et i);

— SOR/2018-99, s. 27(2)

**27 (2) Subsection 31.1(1) of the Regulations is replaced by the following:**

**31.1 (1)** If an unauthorized deposit of a deleterious substance occurs, the owner or operator of a mine shall, without delay, collect a grab sample of effluent at the place where the deposit occurred and determine whether the effluent is acutely lethal by conducting tests on aliquots of each effluent sample in accordance with sections 14.1 to 14.3.

— DORS/2018-99, par. 27(2)

**27 (2) Le paragraphe 31.1(1) du même règlement est remplacé par ce qui suit :**

**31.1 (1)** En cas de rejet non autorisé d'une substance nocive, le propriétaire ou l'exploitant d'une mine prélève sans délai un échantillon instantané d'effluent sur les lieux du rejet non autorisé et détermine si cet effluent présente une létalité aiguë en effectuant des essais conformément aux articles 14.1 à 14.3, sur des portions aliquotes de chaque échantillon d'effluent prélevé.

— SOR/2018-99, s. 32(2)

**32 (2) Schedule 4 to the Regulations is replaced by the Schedule 4 set out in Schedule 2 to these Regulations.**

— DORS/2018-99, par. 32(2)

**32 (2) L'annexe 4 du même règlement est remplacée par l'annexe 4 figurant à l'annexe 2 du présent règlement.**

## SCHEDULE 4

(Subsection 1(2), subparagraphs 4(1)(a)(i) and (ii), subsection 13(1), paragraph 13(3)(a), subparagraph 22(c)(i) and paragraph 24(1)(a))

# Maximum Authorized Concentrations of Prescribed Deleterious Substances

## ANNEXE 4

(paragraphe 1(2), sous-alinéas 4(1)a)(i) et (ii), paragraphe 13(1), alinéa 13(3)a), sous-alinéa 22c)(i) et alinéa 24(1)a))

# Concentrations maximales permises des substances nocives désignées

**TABLE 1**

| | Column 1 | Column 2 | Column 3 | Column 4 |
|---|---|---|---|---|
| Item | Deleterious Substance | Maximum Authorized Monthly Mean Concentration | Maximum Authorized Concentration in a Composite Sample | Maximum Authorized Concentration in a Grab Sample |
| 1 | Arsenic | 0.10 mg/L | 0.15 mg/L | 0.20 mg/L |
| 2 | Copper | 0.10 mg/L | 0.15 mg/L | 0.20 mg/L |
| 3 | Cyanide | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |

| | Column 1 | Column 2 | Column 3 | Column 4 |
|---|---|---|---|---|
| Item | Deleterious Substance | Maximum Authorized Monthly Mean Concentration | Maximum Authorized Concentration in a Composite Sample | Maximum Authorized Concentration in a Grab Sample |
| 4 | Lead | 0.08 mg/L | 0.12 mg/L | 0.16 mg/L |
| 5 | Nickel | 0.25 mg/L | 0.38 mg/L | 0.50 mg/L |
| 6 | Zinc | 0.40 mg/L | 0.60 mg/L | 0.80 mg/L |
| 7 | Suspended Solids | 15.00 mg/L | 22.50 mg/L | 30.00 mg/L |
| 8 | Radium 226 | 0.37 Bq/L | 0.74 Bq/L | 1.11 Bq/L |
| 9 | Un-ionized ammonia | 0.50 mg/L expressed as nitrogen (N) | Not applicable | 1.00 mg/L expressed as nitrogen (N) |

## TABLEAU 1

| | Colonne 1 | Colonne 2 | Colonne 3 | Colonne 4 |
|---|---|---|---|---|
| Article | Substance nocive | Concentration moyenne mensuelle maximale permise | Concentration maximale permise dans un échantillon composite | Concentration maximale permise dans un échantillon instantané |
| 1 | Arsenic | 0,10 mg/L | 0,15 mg/L | 0,20 mg/L |
| 2 | Cuivre | 0,10 mg/L | 0,15 mg/L | 0,20 mg/L |
| 3 | Cyanure | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 4 | Plomb | 0,08 mg/L | 0,12 mg/L | 0,16 mg/L |
| 5 | Nickel | 0,25 mg/L | 0,38 mg/L | 0,50 mg/L |
| 6 | Zinc | 0,40 mg/L | 0,60 mg/L | 0,80 mg/L |
| 7 | Matières en suspension | 15,00 mg/L | 22,50 mg/L | 30,00 mg/L |
| 8 | Radium 226 | 0,37 Bq/L | 0,74 Bq/L | 1,11 Bq/L |
| 9 | Ammoniac non ionisé | 0,50 mg/L sous forme d'azote (N) | Sans objet | 1,00 mg/L sous forme d'azote (N) |

NOTE: The concentrations for items 1 to 8 are total values.

NOTE : Les concentrations pour les articles 1 à 8 sont des valeurs totales.

## TABLE 2

| | Column 1 | Column 2 | Column 3 | Column 4 |
|---|---|---|---|---|
| Item | Deleterious Substance | Maximum Authorized Monthly Mean Concentration | Maximum Authorized Concentration in a Composite Sample | Maximum Authorized Concentration in a Grab Sample |
| 1 | Arsenic | 0.30 mg/L | 0.45 mg/L | 0.60 mg/L |
| 2 | Copper | 0.30 mg/L | 0.45 mg/L | 0.60 mg/L |
| 3 | Cyanide | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |
| 4 | Lead | 0.10 mg/L | 0.15 mg/L | 0.20 mg/L |

| Item | Column 1<br>Deleterious Substance | Column 2<br>Maximum Authorized Monthly Mean Concentration | Column 3<br>Maximum Authorized Concentration in a Composite Sample | Column 4<br>Maximum Authorized Concentration in a Grab Sample |
|---|---|---|---|---|
| 5 | Nickel | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |
| 6 | Zinc | 0.50 mg/L | 0.75 mg/L | 1.00 mg/L |
| 7 | Suspended Solids | 15.00 mg/L | 22.50 mg/L | 30.00 mg/L |
| 8 | Radium 226 | 0.37 Bq/L | 0.74 Bq/L | 1.11 Bq/L |
| 9 | Un-ionized ammonia | 0.50 mg/L expressed as nitrogen (N) | Not applicable | 1.00 mg/L expressed as nitrogen (N) |

**TABLEAU 2**

| Article | Colonne 1<br>Substance nocive | Colonne 2<br>Concentration moyenne mensuelle maximale permise | Colonne 3<br>Concentration maximale permise dans un échantillon composite | Colonne 4<br>Concentration maximale permise dans un échantillon instantané |
|---|---|---|---|---|
| 1 | Arsenic | 0,30 mg/L | 0,45 mg/L | 0,60 mg/L |
| 2 | Cuivre | 0,30 mg/L | 0,45 mg/L | 0,60 mg/L |
| 3 | Cyanure | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 4 | Plomb | 0,10 mg/L | 0,15 mg/L | 0,20 mg/L |
| 5 | Nickel | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 6 | Zinc | 0,50 mg/L | 0,75 mg/L | 1,00 mg/L |
| 7 | Matières en suspension | 15,00 mg/L | 22,50 mg/L | 30,00 mg/L |
| 8 | Radium 226 | 0,37 Bq/L | 0,74 Bq/L | 1,11 Bq/L |
| 9 | Ammoniac non ionisé | 0,50 mg/L sous forme d'azote (N) | Sans objet | 1,00 mg/L sous forme d'azote (N) |

NOTE: The concentrations for items 1 to 8 are total values.

NOTE : Les concentrations pour les articles 1 à 8 sont des valeurs totales.

— SOR/2018-99, ss. 33(2), (3)

**33 (2) Schedule 5 to the Regulations is amended by replacing the references after the heading "Schedule 5" with the following:**

(Subsections 7(1) and (3), subparagraphs 15(1)(a)(i) and (b)(i) and paragraph 32(1)(c))

**(3) Subsection 4(1) of Schedule 5 to the Regulations is amended by adding "and" at the end of paragraph (n), by striking out "and" at the end of paragraph (o) and by repealing paragraph (p).**

— DORS/2018-99, par. 33(2) et(3)

**33 (2) Les renvois qui suivent le titre « Annexe 5 », à l'annexe 5 du même règlement, sont remplacés par ce qui suit :**

(paragraphes 7(1) et (3), sous-alinéas 15(1)a)(i) et b)(i) et alinéa 32(1)c))

**(3) L'alinéa 4(1)p) de l'annexe 5 du même règlement est abrogé.**

— SOR/2018-99, s. 34(1)

**34 (1) Part 2 of Schedule 6 to the Regulations is replaced by the following:**

**PART 2**

# Test Results Respecting Each Final Discharge Point

**1** Complete the following table with the monthly mean concentration for the deleterious substances set out in the table for each final discharge point and identify the location of the final discharge point.

**2** Any measurement not taken because there was no deposit from the final discharge point shall be identified by the letters "NDEP" (No Deposit).

**3** Any measurement not taken because no measurement was required in accordance with the conditions set out in section 12 or 13 of these Regulations shall be identified by the letters "NMR" (No Measurement Required).

— DORS/2018-99, par. 34(1)

**34 (1) La partie 2 de l'annexe 6 du même règlement est remplacée par ce qui suit :**

**PARTIE 2**

# Résultats des essais à chacun des points de rejet final

**1** Remplir le tableau suivant pour chaque point de rejet final, identifier son emplacement et indiquer la moyenne mensuelle de la concentration des substances nocives.

**2** S'il n'y a pas eu de résultats parce qu'il n'y avait pas de rejet à partir du point de rejet final, inscrire « A.R. » (aucun rejet).

**3** S'il n'y a pas eu de mesure parce que l'article 12 ou 13 du présent règlement n'en exigeait aucune, inscrire « A.M.E. » (aucune mesure exigée).

| Location of final discharge point: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | As (mg/L) | Cu (mg/L) | CN (mg/L) | Pb (mg/L) | Ni (mg/L) | Zn (mg/L) | SS (mg/L) | Ra 226 (Bq/L) | Un-ionized ammonia (mg/L, expressed as Nitrogen (N)) | Lowest pH | Highest pH | Effluent Volume ($m^3$) |
| Jan. | | | | | | | | | | | | |
| Feb. | | | | | | | | | | | | |
| Mar. | | | | | | | | | | | | |
| Apr. | | | | | | | | | | | | |
| May | | | | | | | | | | | | |
| June | | | | | | | | | | | | |
| July | | | | | | | | | | | | |
| Aug. | | | | | | | | | | | | |
| Sept. | | | | | | | | | | | | |
| Oct. | | | | | | | | | | | | |
| Nov. | | | | | | | | | | | | |
| Dec. | | | | | | | | | | | | |

| Emplacement du point de rejet final : | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mois | As (mg/L) | Cu (mg/L) | CN (mg/L) | Pb (mg/L) | Ni (mg/L) | Zn (mg/L) | SS (mg/L) | Ra 226 (Bq/L) | Ammoniac non ionisé (mg/L sous forme d'azote (N)) | pH le plus bas | pH le plus haut | Volume d'effluent ($m^3$) |
| Janv. | | | | | | | | | | | | |
| Févr. | | | | | | | | | | | | |
| Mars | | | | | | | | | | | | |
| Avr. | | | | | | | | | | | | |
| Mai | | | | | | | | | | | | |
| Juin | | | | | | | | | | | | |
| Juil. | | | | | | | | | | | | |
| Août | | | | | | | | | | | | |
| Sept. | | | | | | | | | | | | |
| Oct. | | | | | | | | | | | | |
| Nov. | | | | | | | | | | | | |
| Déc. | | | | | | | | | | | | |

— SOR/2018-99, s. 34(3)

**34 (3)** **Part 3 of Schedule 6 to the Regulations is replaced by the following:**

— DORS/2018-99, par. 34(3)

**34 (3)** **La partie 3 de l'annexe 6 du même règlement est remplacée par ce qui suit :**

**PART 3**

# Results of Acute Lethality Tests

| Location of final discharge point: | | | |
|---|---|---|---|
| Date Sample Collected | Results for Rainbow Trout Acute Lethality Tests (mean percentage mortality in 100% effluent test concentration) | Results for *Daphnia magna* Acute Lethality Tests (mean percentage mortality in 100% effluent test concentration) | Results for Threespine Stickleback Acute Lethality Tests (mean percentage mortality in 100% effluent test concentration) |
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**PARTIE 3**

# Résultats des essais de détermination de la létalité aiguë

| Emplacement du point de rejet final : | | | |
|---|---|---|---|
| Date du prélèvement de l'échantillon | Résultats des essais de détermination de la létalité aiguë sur la truite arc-en-ciel (pourcentage moyen de mortalité dans l'effluent non dilué) | Résultats des essais de détermination de la létalité aiguë sur la *Daphnia magna* (pourcentage moyen de mortalité dans l'effluent non dilué) | Résultats des essais de détermination de la létalité aiguë sur l'épinoche à trois épines (pourcentage moyen de mortalité dans l'effluent non dilué) |
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# APPENDIX C
# EMERGENCY RESPONSE TRUCK INVENTORY

The information contained herein is proprietary to Baffinland Iron Mines Corporation and is used solely for the purpose for which it is supplied.
It shall not be disclosed in whole or in part, to any other party, without the express permission in writing by Baffinland Iron Mines Corporation.

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Baffinland

# Rescue EMG-005









**Equipment checklist** **Date:** **Time:** **Inspector:**

N/A - Not Applicable

| Compartment | Items | | Yes | Condition | Full | Empty | Tested | Comments |
|---|---|---|---|---|---|---|---|---|
| **Cabin** | | **Sat Phone** | | | | | | **Check Battery level** |
| | **1** | Safety Glasses clear box | | | | | | |
| | **1** | Safety glasses Darks box | | | | | | |
| | **1** | Binoculars | | | | | | |
| | **1** | Rolls of duck tape | | | | | | |
| | **2** | Care Flare | | | | | | |
| | **1** | Emergency Road kit | | | | | | |
| | **1** | First Aid kit | | | | | | |
| | **1** | Thermal Imaging Camera | | | | | | **Change with spare battery** |
| | **4** | Eyewash | | | | | | |
| | **1** | 10 pound fire extinguisher | | | | | | |
| **1 Left Compartment** | **7** | 5 Delta Air, 2 Scott 2.2 | | | | | | |
| | **17** | SCBA Cylinder | | | | | | |
| | **21** | SCBA face Masks (straps extended) | | | | | | |
| | **1** | Piercing Nozzle with Shut Off | | | | | | |
| | **1** | Red Rope (coil) | | | | | | |
| | **1** | Rit Pack | | | | | | |
| | **10** | Banks Pelican flashlights | | | | | | |
| **2 Left Compartment** | **1** | Step Ladder | | | | | | |
| | **1** | Skill Saw, 1 blade | | | | | | |
| | **1** | Cable Power Puller | | | | | | |
| | **1** | Saws all (reciprocating saw) | | | | | | |
| | **1** | Saws all Blades (kits) | | | | | | |
| | **3** | Drill Bits set | | | | | | |
| | **1** | Cordless drill | | | | | | |
| | **1** | Tape measure | | | | | | |
| | **1** | Socket Set | | | | | | 9mm socket missing |
| | **1** | Wrench Set (in tool box) | | | | | | |
| | **2** | Boxes of 30' socks | | | | | | |
| | **1** | roll mech wire | | | | | | |
| | **1** | Tool Box with assorted tools | | | | | | |
| | **1** | Large Bolt Cutters | | | | | | |
| | **3** | Battery Charger | | | | | | |
| | **8** | Batteries Dewalt | | | | | | |
| | **2** | Battery Milwakee | | | | | | |
| | **1** | Charger & battery TIC | | | | | | |
| | **1** | Safety Glasses (box) Assorted | | | | | | |
| | **1** | Small Axe | | | | | | |
| | **1** | Small Bolt Cutters | | | | | | |
| | **1** | Haligan Bar | | | | | | |
| | **2** | Axe | | | | | | |
| | **2** | Pick Head Axe | | | | | | |
| | **1** | Fire Pole | | | | | | |
| | **1** | Steel Jerry can (gas) | | | | | | |
| | **1** | Plastic Jerry Can (gas) | | | | | | |
| | **1** | portable Fan | | | | | | **Start and run for 5 min** |
| | **1** | Yellow rope (spool) | | | | | | |
| | | Miscellaneous Oils | | | | | | |
| | **2** | Chop Saw Blade | | | | | | |
| | **1** | Power pack for Jaws of Life | | | | | | **Start and run for 5 min** |
| | **1** | Chain Saw chain | | | | | | |
| | **1** | Duck Tape | | | | | | |
| | **1** | Red Cordless Drill/Charger/Batteries | | | | | | |
| **3 Left Compartment** | **1** | Portable Fan (electric) | | | | | | |
| | **2** | Tarps | | | | | | |
| | **3** | Ratchet Straps | | | | | | |
| | **1** | Air Hammer | | | | | | |
| | **1** | 20 ton bottle jack | | | | | | |
| | **3** | Hurst Tool Hose | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | Spreader | | | | | | |
| | 1 | Cutter | | | | | | |
| | 1 | Combi Tool | | | | | | |
| | 1 | Ram | | | | | | |
| | 1 | Gloves | | | | | | |
| | 1 | Regulator Assembly | | | | | | |
| | 2 | Air Hoses | | | | | | |
| | 1 | 32" Air bag | | | | | | |
| | 1 | 13" Air Bag | | | | | | |
| | 1 | 1/2 air impact | | | | | | |
| | 1 | 80 ton Air bag | | | | | | |
| | 2 | Grizzly Struts | | | | | | |
| | | Assorted Cribbing | | | | | | |
| **4 Left Compartment** | 2 | 1.5 inch hose (yellow) | | | | | | |
| | 4 | 1.5 inch hose (red) | | | | | | |
| | 3 | 2.5 inch hose (white) | | | | | | |
| | 4 | 2.5 inch hose (red) | | | | | | |
| | 6 | Mustang suits | | | | | | |
| | 1 | Spanners | | | | | | |
| | 4 | 1.5 inch nozzle | | | | | | |
| | 1 | 3 inch adapter 2.5" | | | | | | |
| | 1 | 1.5" plastic Nozzle | | | | | | |
| | 2 | 10 lbs. extinguisher | | | | | | |
| | 1 | 6" connector pipe for portatanks | | | | | | |
| | 1 | Rolligliss 550 | | | | | | |
| | | Wood (cribbing) | | | | | | |
| | 1 | Chainsaw | | | | | | **Start and run for 5 min** |
| | 1 | Rescue Saw | | | | | | **Start and run for 5 min** |
| | 2 | 20lbs fire extinguisher | | | | | | |
| **5 Left Compartment** | 6 | Exo Fit harness | | | | | | |
| | 1 | Rollglis R 550 | | | | | | |
| | 6 | Self Inflatable Life vests | | | | | | |
| | 4 | Boots (pairs) (Hip waiters) | | | | | | |
| | 3 | Rescue rope (200 foot bags) | | | | | | |
| | 1 | Tripod straps and pullies (bag)Top of ARFF | | | | | | |
| | 4 | Climbing harness | | | | | | |
| | 3 | Petzl AVAO Harness | | | | | | |
| | 1 | Edge covers (bag) | | | | | | |
| | 8 | Rock climbing helmet | | | | | | |
| | 1 | Rescue ring | | | | | | |
| | 1 | Life jackets (bag) of 4 | | | | | | |
| | 9 | Air horn | | | | | | |
| | 1 | Kovak Ice drillkit | | | | | | |
| | 1 | Bag assorted webbing straps | | | | | | |
| | 2 | Mini 4:1 | | | | | | |
| | 3 | Bags of Caribiner | | | | | | |
| | 1 | Bag Prusick | | | | | | |
| | 1 | Pelican case Assorted High angle rescue gear | | | | | | |
| | 2 | Assender kits | | | | | | |
| | 4 | Pylons | | | | | | |
| | 2 | Beam Clamps | | | | | | |
| | 1 | Rope Launcher | | | | | | |
| | 2 | 400' rope bags | | | | | | |
| | 2 | Confined space SCBA (Black case | | | | | | |
| | 5 | 6' lanyard | | | | | | |
| | 2 | Telescopic reach pole | | | | | | |
| **1 Right Compartment** | 16 | Orange blankets | | | | | | |
| | 1 | Kendrick Extrication Device (KED) | | | | | | |
| | 8 | Folding stretchers | | | | | | |
| | 1 | White plastic rigid Leg splint | | | | | | |
| | | | | | | | | |
| | 8 | Safety vests | | | | | | |
| | 4 | Misc. rigid splints (sets) (orange bag) | | | | | | |
| | 1 | 6 Bank Radio Charger (5 batterys) | | | | | | |
| | 1 | Ferno Stair chair | | | | | | |
| | 2 | Spider Straps | | | | | | |
| | 1 | Burn kit | | | | | | |
| | 2 | Neck brace | | | | | | |
| | 5 | Quick connect straps (back board) | | | | | | |
| | 3 | Trauma bag (red) | | | | | | **Check Expiry Data (Burn Kits, Sterile water)** |
| | 4 | CID blocks (orange) | | | | | | |
| | 2 | Flashlights (Box) MAG lites | | | | | | |
| | 1 | Incident Command Board | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **3** | Roll Caution tape | | | | | | |
| | **3** | Roll Danger tape | | | | | | |
| | **1** | SKED | | | | | | |
| | **1** | SCBA Mask cleaning wipes | | | | | | |
| | **1** | Bag stretcher cover | | | | | | |
| | **1** | Nutragrain bars | | | | | | |
| | **2** | Basket Stretcher kits (complete) | | | | | | |
| **2 Right Compartment** | **1** | Empty Cube Totes | | | | | | |
| | **1** | 6" tube for portable tank | | | | | | |
| | | Diaphragm pump (Hoses) | | | | | | |
| **3 Right Compartment** | **3** | Quatrex bags (white) | | | | | | |
| | **2** | Lithium fire extinguisher | | | | | | |
| | **2** | Magnesium fire extinguisher | | | | | | |
| | **4** | Grey spill pads | | | | | | |
| | **4** | 12x 18 tarp | | | | | | |
| | **2** | Boxes of 30' sock | | | | | | |
| | **2** | Backboard | | | | | | |
| | **1** | Water bottle/sleeve cups | | | | | | |
| | **9** | coveralls | | | | | | |
| | **1** | 4 white spill pads | | | | | | |
| **4 Right Compartment** | **1** | 1000 VSG Bladder | | | | | | |
| | **1** | 5000 VSG Bladder | | | | | | |
| | **1** | 15000 VSG Bladder | | | | | | |
| | **5** | Quatrex bags (black) | | | | | | |
| | **3** | Bladder repair kits | | | | | | |
| | **1** | 4X4 duck pond | | | | | | |
| | **2** | Box 30' spill boom | | | | | | |
| | **3** | Bladder fitting kit | | | | | | |
| **5 Right Compartment** | **1** | Spade | | | | | | |
| | **2** | Mass Casualty Kits | | | | | | **Check Expiry Data (Burn Kits, Sterile water)** |
| | **2** | Rake | | | | | | |
| | **1** | Push broom | | | | | | |
| | **2** | Shovel (square head) | | | | | | |
| | **2** | Chicken wire (roll) | | | | | | |
| | **12** | Long gloves (pair) | | | | | | |
| | **6** | Extension cord | | | | | | |
| | **1** | Honda GX 270 trash pump | | | | | | **Start and run for 5 min** |
| | **1** | 3 inch flat hose | | | | | | |
| | **3** | Tyvek coveralls (box) | | | | | | |
| | **1** | Funnel | | | | | | |
| | **1** | Gap seal; 20 L bucket (plug agent) | | | | | | |
| | **1** | Scoop | | | | | | |
| | **3** | 3 inch x 10 foot spill booms (box) | | | | | | |
| | **4** | Cones | | | | | | |
| | **2** | Dumpster liners | | | | | | |
| | **1** | Box of Garbage bags | | | | | | |
| | **3** | Spill pads white | | | | | | |
| | **1** | Honda generator | | | | | | **Start and run for 5 min** |
| | **4** | spill pads  Grey | | | | | | |

MRT Emergency Response Truck

Right Side:



Left Side:



# APPENDIX D
# MINE SITE SPILL KIT INVENTORY AND LOCATIONS


The information contained herein is proprietary to Baffinland Iron Mines Corporation and is used solely for the purpose for which it is supplied.
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557 750 E
558 500 E
559 250 E
560 000 E
560 750 E
561 500 E
7 914 500 N
7 913 750 N
7 913 000 N
7 912 250 N
7 911 500 N
CAMP LAKE
SHEARDOWN LAKE
AIRSTRIP
ᐱᓕᕆᔨᓄᑦ ᓄᓇᕗᑦᑐᕐᓂᖅ ᓇᓕᒻᒥᑦ
EXPLORATION CAMP FACILITIES
ACCOMMODATION CAMP
ACCOMMODATION CAMP

**LEGEND - SPILL KITS:**

1. 104 LAYDOWN
2. EMULSION PLANT
3. FP 1
4. FP 2
5. DIESEL MODULE 1
6. DIESEL MODULE 2
7. WWTP
8. MRT
9. WELDING SHOP 1
10. WELDING SHOP 2
11. MTC SHOP 1
12. MTC SHOP 2
13. MTC SHOP 3
14. MTC SHOP 4
15. MTC SHOP 5
16. MTC SHOP 6
17. MTC SHOP 7
18. WASH BAY 1
19. WASH BAY 2
20. WASH BAY 3
21. WASH BAY 4
22. WASH BAY 5
23. TOROMONT 1
24. TOROMONT 2
25. TOROMONT 3
26. TOROMONT 4
27. CRUSHER 1
28. CRUSHER 2
29. CRUSHER 3
30. CRUSHER 4
31. CRUSHER 5
32. CRUSHER 6
33. CRUSHER POND
34. NEW CAMP PAD 1
35. NEW CAMP PAD 2
36. NEW CAMP PAD 3
37. NEW CAMP PAD 4
38. NEW CAMP PAD 5
39. NEW CAMP PAD 6
40. OHT LAYDOWN
41. LAYDOWN
42. QUARRY
43. JET A TANK
44. FIGHT OPS 1
45. FIGHT OPS 2
46. SITE SERVICE SHOP
47. WAREHOUSE
48. HWB 6
49. INCINERATOR BUILDING
50. HWB 1
51. HWB 2
52. HWB 3
53. HWB 4
54. HWB 5
55. HELI PAD FUEL STATION
56. WEATHER HAVEN
57. ENVIRONMENT LAYDOWN

**ᑐᑭᓯᖏᑦ**
**LEGEND:**

- ᐃᓄᐃᑦ ᓄᓇᕗᑦᑐᓂᓗ - ᖃᓄᓂ ᓴᕐᓴᓴᐃᑦ ᐱᖁᓯᐅᑎᕐᓗᓂᑦ
  INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS
- ᐃᓄᐃᑦ ᓄᓇᕗᑦᑐᓂᓗ - ᖃᓄᓂ ᐊᒥᓗᓐ ᐱᖁᓯᐅᑎᓂᑦ ᓴᕐᓴᓴᖅᓯᕐᓂᑦ
  INUIT OWNED LAND - SURFACE AND SUBSURFACE INCLUDING MINERALS
- ᐃᒥᖅ
  WATER
- ᐅᓴᐅᑦᓴᕐᓂᑦ ᐃᓚᖓᓗ (ᐱᒋᐊᕆᔭᒃᑐᑦ ᐅᕙᓐ Q13C301)
  QUARRY AREA (EXISTING UNDER Q13C301)
- ᐅᑐᓂᖅ/ᐊᒡᓚᑦᑐᖅ/ᐃᓕᓴᐅᕙᓐ
  RIVER/STREAM/DRAINAGE
- ᐊᑐᓕᖅ
  ROAD
- ᖃᓄᐃᓕᓐᓂ ᐃᓄᐃᑦ ᑲᑎᕆᔨᖏᑦᑐᑦ ᖃᖓᓂᑦ ᓄᓇᒃᑎ ᑭᓇᐅᔭᓕᕆᔨᐅᓪᓗᐊᖅᑎᑦᓂᑦ ᐊᑐᑐᒃᓴᑕᐅᔪᑦ ᑭᓚᖓ
  QIA SURFACE COMMERCIAL LEASE BOUNDARY
- SPILL KIT LOCATION

**NOTES:**

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN BASED ON INFORMATION PROVIDED BY HATCH, DATED JAN 13, 2015, AND 2017.
4. CONTOUR INTERVAL IS 2.5 METRES.

**ᖃᐅᔨᓪᓚᖅᓴᐃᓪᓕᐸᑦ:**

1. ᓄᓇᕗᒻᒥ ᑎᑎᕐᓚᓂᖅ ᒪᓕᒐᓐᖅ UTM NAD83 ZONE 17N.
2. ᓄᓇᕗᑦᓂᓕᕆᓂᖅᑕᑦ EAGLE MAPPING (2005).
3. ᐸᓇᒧᓐᖏᐃᑎᓂᕐᒪᑦ ᑐᓴᒪᓂᓐᓄᑦ ᑐᓴᐅᒪᔪᑎᑎᓴᑦ ᑐᓄᐅᑎᓪᓚᑦ ᐄᓕᐅᔨᑦ, ᐅᓪᓗᖓᑦᓄᑎᑎᓂ ᖃᓄᓐᓇᓐ 13, 2015 , 2017.
4. ᑎᑎᕐᓚᓂᖅ ᒥᑦ ᐊᐅᓚᓂᑦ ᐅᖃᓕᓂᑎᑎᓴᑦ 2.5 ᒥᑦ

ᐊᑎᓚᖓ SCALE A 150 75 0 250 500 750 m

Baffinland

MARY RIVER PROJECT

**MINE SITE SPILL KIT LOCATIONS**

Knight Piésold CONSULTING

| P/A NO. | REF NO. |
|---|---|
| NB102-181/41 | NB17-00729 |

**FIGURE 2**

REV 0

| REV | DATE | DESCRIPTION | DESIGNED | DRAWN | REVIEWED |
|---|---|---|---|---|---|
| 0 | 02NOV'17 | ISSUED WITH TRANSMITTAL | RAC | MMD | CD |

SAVED: I:\1\02\00181\41\A\Cad\FIGS\B11 r0 11/2/2017 3:09:41 PM, MDEMERS PRINTED: 11/2/2017 3:13:13 PM, MDEMERS
XREF FILES: Contours-2.5m_Intervel-Mine_to_Mary_Site-02-Oct_16_2003; MINE SITE LAYOUT_KN-TOPO-BASE-LANDUSE-; CLAS IMAGE FILLES; GIS Baffinland Logo.mitne_ateit_wx3745_wv2_wv3_aug2016_ab-2d.mitne_ateit_wx3745_wv2_wv3_aug2016_bw27

| Inventory of Typical Spill Kits | |
|---|---|
| **Amount** | **Description** |
| 1 | 30 Gallon Drum with Lid |
| 50 | Sorbent Pads |
| 4 | Sorbent Socks |
| 2 | Sorbent Booms |
| 1 | Shaker of Safety Sorb |
| 1 | Neoprene Drain Cover |
| 1 | Disposable Bag |
| 2 Pair | Safety Goggles |
| 2 Pair | Nitrile Gloves |

* Best efforts are made to ensure spill kits remain fully stocked at their designated locations.

# APPENDIX E
# NT-NU SPILL REPORT FORM

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# NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

**NT-NU 24-HOUR SPILL REPORT LINE**
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

**REPORT LINE USE ONLY**

| | | | | |
|---|---|---|---|---|
| A | REPORT DATE: MONTH – DAY – YEAR | REPORT TIME | ☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT | REPORT NUMBER ____-_____ |
| B | OCCURRENCE DATE: MONTH – DAY – YEAR | OCCURRENCE TIME | | |

| | | |
|---|---|---|
| C | LAND USE PERMIT NUMBER (IF APPLICABLE) | WATER LICENCE NUMBER (IF APPLICABLE) |
| D | GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION | REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN |
| E | LATITUDE DEGREES MINUTES SECONDS | LONGITUDE DEGREES MINUTES SECONDS |

| | | | |
|---|---|---|---|
| F | RESPONSIBLE PARTY OR VESSEL NAME | RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION | |
| G | ANY CONTRACTOR INVOLVED | CONTRACTOR ADDRESS OR OFFICE LOCATION | |
| H | PRODUCT SPILLED | QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES | U.N. NUMBER |
| | SECOND PRODUCT SPILLED (IF APPLICABLE) | QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES | U.N. NUMBER |
| I | SPILL SOURCE | SPILL CAUSE | AREA OF CONTAMINATION IN SQUARE METRES |
| J | FACTORS AFFECTING SPILL OR RECOVERY | DESCRIBE ANY ASSISTANCE REQUIRED | HAZARDS TO PERSONS, PROPERTY OR ENVIRONMENT |
| K | ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS | | |

| | | | | | |
|---|---|---|---|---|---|
| L | REPORTED TO SPILL LINE BY | POSITION | EMPLOYER | LOCATION CALLING FROM | TELEPHONE |
| M | ANY ALTERNATE CONTACT | POSITION | EMPLOYER | ALTERNATE CONTACT LOCATION | ALTERNATE TELEPHONE |

**REPORT LINE USE ONLY**

| | | | | | |
|---|---|---|---|---|---|
| N | RECEIVED AT SPILL LINE BY | POSITION STATION OPERATOR | EMPLOYER | LOCATION CALLED YELLOWKNIFE, NT | REPORT LINE NUMBER (867) 920-8130 |

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC

SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN

FILE STATUS ☐ OPEN ☐ CLOSED

| AGENCY | CONTACT NAME | CONTACT TIME | REMARKS |
|---|---|---|---|
| LEAD AGENCY | | | |
| FIRST SUPPORT AGENCY | | | |
| SECOND SUPPORT AGENCY | | | |
| THIRD SUPPORT AGENCY | | | |

# APPENDIX F
# WASTE POND WATER TREATMENT PLANT OPERATIONS

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# Baffinland Iron Mines Corporation

## Waste Pond Water Treatment Plant Operations

## Rev 1.0


**Prepared By: Chet Fong**
**Department: Mine Operations**
**Title: Senior Mining Engineer**
**Date: 17/08/2018**
**Signature:**

**Approved By: Simon Fleury**
**Department: Mine Operations**
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# DOCUMENT REVISION RECORD

| Issue Date MM/DD/YY | Revision | Prepared By | Approved By | Issue Purpose |
|---|---|---|---|---|
| 08/17/18 | V1.0 | CF | | Initial |
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# 1 PURPOSE

This document outlines the basic procedure to safely operate the Water Treatment Plant

# 2 SCOPE

This document will cover the basic operations of the plant, including start up and shut down, monitoring, treatment, and emergency protocols and procedures for at risk activities at the Water Treatment Plant.

## 2.1 EXEMPTIONS

This document does not include instructions related to water treatment, which can be found in the plant Operations and Maintenance Manual.

# 3 RESPONSIBILITES

Any visitor shall request permission to the plant operator prior to entering the work area. In the absence of an operator, permission shall be requested to the mine supervisor.

The Plant operator shall ensure that everyone working in the plant wears the requisite PPE according to the activities being performed (e.g. chemical handling).

# 4 PROCEDURES

The information in this section is intended as a summary of plant operations. In the case of a discrepancy between this document and the Operations and Maintenance Manual, the latter will take precedence.

For full details on design and plant operation, refer to the operator's manual. In standard operations, the WTP is intended to draw water from the Waste Dump Pond and treat the intake water in 3 steps inside the WTP structure. The water is then discharged to a Geotube Settling Pond, where a fourth treatment step of settlement will occur, before water is either discharged into the environment or, if not compliant, recirculated back to the Waste Dump Pond.

The three steps of treatment involve the injection of chemical into temporary storage tanks.

- Step 1 – Iron Precipitation
- Step 2 – Hydroxide Precipitation and pH Adjustment

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- Step 3 – Flocculation
- Step 4 - Filtration

Steps 1-3 occur inside the WTP structure, with the 4th step taking place in the Geotube Settling Pond.

## 4.1 PLANT OPERATIONS

Plant operations consists primarily of managing flow, dosage and water levels across the pond, sump, and tanks. Flow is managed with a combination of control panel adjustments and manual valve manipulations.

The plant consists of the following components:

1. Intake Pump – pulls water from the Waste Dump Pond into the WTP
2. Onion tanks – water is stored for treatment prior to discharge. There are two trains, which can be run independently or concurrently.
3. Control panel – use to remotely manage pumps – can be set for automatic and manual operations
4. Dosing pumps – use to inject chemical into onion tanks at a fixed rate
5. Dosing tanks – mixing tanks from which chemicals (Lime, Polymer) is depleted at a configurable rate
6. Transfer pumps – used to take treated water from the plant out to the Geotube Pond
7. Geotube Pond – discharge from the plant is deposited here for particulate settlement prior to final discharge.
8. Discharge pump – used to pull treated water from the Geotube Pond to either be discharged into the environment or recirculated back to the Waste Dump Pond.
9. Blower motors – used to agitate water in onion tanks during treatment to ensure more even dispersion of chemicals.

Once the Plant is operational, the operator will commence with monitoring the measured levels of pH and suspended solids with built in instrumentations and gauges. These readings may be corroborated with manual instrumentations such as a YSI meter.

When readings indicate pH readings at the desired values, the operator shall then initiate discharging of water into the Geotube Pond. This water is allowed to percolate through the Geotube, which catches particulates as a filter. Once in the Sump, where any remaining particulates are then captured and settle into the bottom of the pond.

Water is discharged from this Geotube Pond, either directly into the environment or back into the Waste Dump Pond. The maximum flow rate for these discharging is 1200 gal/min, this limit imposed by the flowmeter installed.

At design capacity, the intake pump(s) should be able to pull water into the WTP for treatment at an equal rate to the discharge pump. The plant effectively runs continuously with dosing in-stream.

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## 4.2 Plant Start up

The following steps should be undertaken when starting up the WTP.

1. Ensure blower motors are activated.
2. Ensure all the Valves to the Geotube Sump are open.
3. Ensure the transfer pumps are switched to automatic
4. Check that all the intake valves are open
5. Keep valves open between tanks on each train
6. Start up intake pump and adjust pressure accordingly. To do this, adjust the following:
    a. Rpm of the pump
    b. Valve openings
7. Start Ferric Sulphate Dosing system. Ensure intake is in the Ferric Sulphate barrels, and there are no leaks present. Pumps should be activated.
8. Start Lime Dosing system. Dosing pumps should be activated.
9. Start up Polymer Dosing System. Dosing pumps should be activated

Plant operations can now commence.

## 4.3 Plant Shut Down

Plant shut down can be undertaken when it is to be unmanned for a longer period of time (eg. More than 2 shifts) within the same system (for winter decommissioning, procedure XXX). To run a plant shut down

1. Shut all intake valves
2. Shut all Ferric Sulphate dosing equipment
3. Shut all Lime dosing equipment
4. shut all Polymer dosing equipment
5. Rinse Lime lines (reference other procedure)

Plant can now be shut down. This procedure can be utilized with the onion tanks full. This should also be done before any interruptions in power due to generator maintenance or other causes.

## 4.4 Discharging

Discharging be undertaken whenever the plant is running. It is most efficient to run the discharge when there is moderate to high water levels in the Geotube Sump. The intake hose for the Geotube Sump should utilize the ring to ensure that drawn water is from the top of the water surface.

Discharging requires the manual operation of the valves to discharge the water either to the environment or back to the Waste Dump Pond. Readings should also be checked and logged on the flowmeter when discharge begins using the totalizer values.

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NOTE: discharge flow rate should be kept below 1200 gal/min, as flow greater than this will not be measureable.

To discharge, the following steps should be undertaken:

1. Ensure enough water to discharge. Water levels should be at least 50 centimetres from the bottom of the sump prior to beginning discharge.
2. Ensure valve on re-circulation line is closed. This will enable the water to discharge into the environment. Where re-circulation is required, close the valve on the discharge line and open the valve on the re-circulation line.
3. If discharging to the environment, check the totalizer reading on the flowmeter prior to discharge. This is not required if re-circulating.
4. On the control panel, Set discharge to "on"
5. While discharging, check discharge pH and Turbidity with sampling tap periodically. Samples can be collected and tested using YSI instrument.
6. When discharging is complete or to be disabled, go to control panel and set discharge to "off"

## 4.5 CHEMICAL DOSING

Chemical dosing is performed as part of the treatment process. The primary drivers for chemical dosing is:

1. Reduce the pH
2. Reduce the suspended solids

Prior to discharging water back into the environment.

As dosing quantities will vary depending on flow rate and water qualities, refer to user manual for dosing quantities.

Dosing procedures will vary slightly between the stages of treatment. The three stages that require chemical intervention are Ferric Sulphate, Lime, and Polymer.

### 4.5.1 FERRIC SULPHATE – LIQUID

PPE Required: long chemical resistant gloves, apron, face shield, standard PPE

- Prepare a barrel for dosing by placing the barrel into the duck pond by the ferric sulphate dosing area and removing the top seal.
- Put 2 dosing pumps into 1 barrel (1 per train)
- Switch on dosing pump on the control panel
- On the pump, check frequency and stroke length to ensure dosage is as expected.
- To change barrels, switch off on the dosing pump and change barrel

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#### 4.5.2 LIME – BAGS

PPE Required: long chemical resistant gloves, respirator, face shield, respirator, standard PPE

- Fill mixing tank with intake water.
- Check filter on accessory intake water line (dedicated line for filling lime and polymer mixing tanks)
- Open valve on AI water line (fill tank). Fill to required water levels
- Ensure mixer is operating
- Add lime to water

#### 4.5.3 POLYMER – BAGS

PPE Required: standard PPE

- Fill mixing tank with intake water.
- Check filter on accessory intake water line (dedicated line for filling lime and polymer mixing tanks)
- Open valve on AI water line (fill tank). Fill to required water levels
- Ensure mixer is operating
- Add polymer to water

### 4.6 SYSTEM AUTOMATION

For instruction on System Automation, please refer to the Operations and Maintenance Manual.

### 4.7 TROUBLE SHOOTING

For issue identification, please refer to the checklists in the Operations and Maintenance Manual.

### 4.8 ACCIDENT RESPONSE

As the WTP involves the handling of a number of chemicals that may be harmful, precautions must be taken to ensure all personnel who are in the work area are informed of the hazards and the preventative and treatment measures.

#### 4.8.1 RESPONSE EQUIPMENT AVAILABLE

The WTP is equipped with a stationary emergency shower, 2 portable emergency shower stations and eyewash stations (dual purpose), 2 fire extinguishers, and 1 stationary eyewash station.

Additionally, the WTP is equipped with spare PPE, face shields, respirators, chemical resistant gloves, hearing protection, and spill kits.

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There are also patch kits for the onion tanks, hose and fitting replacements, tools, and a base station radio available at the WTP.

In the event that an incident occurs that requires emergency response, same basic steps should be immediately undertaken. The following lists some of the possible situations and a brief of the response steps.

### 4.8.2 Spills on the ground

- Retrieve spill pad kit
- use gloves to handle
- dispose in drum
- Label and dispose.

### 4.8.3 Spills on person

- Proceed to stationary emergency shower
- Notify secondary operator
- Secondary operator activates pump switch
- Pull handle and rinse for 10 mins
- If unable to proceed to stationary emergency shower, refer to “emergency response procedure”

### 4.8.4 Lime in eyes

- If possible, proceed immediately to emergency eyewash station
- Activate emergency eyewash and rinse for 10 mins.
- Repeat if required
- Notify secondary operator
- If unable to proceed to emergency eyewash station, refer to “emergency response procedure”

### 4.8.5 Lime spill

- Retrieve spill pad kit
- use gloves to handle
- dispose in drum
- Label and dispose.

## 4.9 APPENDICIES

*Appendix A – Operations and Maintenance Manual for Mary River Mine Waste Rock Pile Water Treatment Plant*

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# APPENDIX A – OPERATIONS & MAINTENANCE MANUAL FOR MARY RIVER MINE WASTE ROCK PILE WATER TREATMENT PLANT
# 20180817_v02

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# OPERATIONS & MAINTENANCE MANUAL FOR MARY RIVER MINE WASTE ROCK PILE WATER TREATMENT PLANT 20180817_v02

**Baffinland Iron Mines Corporation**

**Prepared by:**

**McCue Engineering Contractors**
203-8291 92 Street
Delta, BC
V4G 0A4

Project No. 137-0001

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# 1.0 INTRODUCTION

This documents outlines the Operations Manual for Baffinland Iron Mine Corporation's (BIM) Mary River Mine Waste Rock Pile water treatment plant (WTP).

# 2.0 PLANT OVERVIEW

## 2.1 General Process Description

The WTP employs a process of coagulation, pH adjustment, flocculation, and filtration to treat acid rock surface runoff collected in the pond at the base of the waste rock pile. The objective of the system operation is to treat water to within the parameters outlined in the Metal Mining Effluent Regulations (MMER), as specified to McCue by BIM, and summarized in Table 1.

**Table 1: MMER Effluent Limits**

| Parameter | Unit | Maximum Authorized Monthly Mean Concentration | Maximum Authorized Concentrations in a Composite Sample | Maximum Authorized Concentration in a Grab Sample |
|---|---|---|---|---|
| Arsenic | mg/L | 0.5 | 0.75 | 1.00 |
| Copper | mg/L | 0.3 | 0.45 | 0.60 |
| Cyanide | NTU | 1.00 | 1.50 | 2.00 |
| Lead | mg/L | 0.20 | 0.30 | 0.40 |
| Nickel | mg/L | 0.50 | 0.75 | 1.00 |
| Zinc | mg/L | 0.50 | 0.75 | 1.00 |
| Total Suspended Solids | mg/L | 15.00 | 22.50 | 30.00 |
| Radium 226 | Bq/L | 0.37 | 0.74 | 1.11 |
| pH | SU | 6-9.5 | 6-9.5 | 6-9.5 |

The treatment steps are described in Section 2.2. Refer to drawings in Appendix A:

## 2.2 Brief Process Overview

### 2.2.1 *System Inlet*

Water is collected at an inlet storage pond (P-001) where it is held for treatment. Two diesel powered centrifugal trash pumps (PU-100A/B) are used to transfer water from the storage pond to an equipment enclosure where the WTP is housed.

At the WTP, the flow can be divided into two separate treatment trains (1 and 2), with each train having a flow meter on the inlet line to monitor flow.

Water is directed into two reactor tanks (TA-110 and TA-210) for processing.

### 2.2.2 *Step 1 – Iron Precipitation*

Ferric sulphate solution is injected into TA-110 and TA-210 to promote coagulation and precipitation of some heavy metals.

As of system commissioning in June 2018, ferric sulphate liquid solution (12% Fe) is used and injected directly into the process. Each process train utilizes an independent chemical pump to introduce chemical into the system.

The WTS also includes a ferric sulphate make down system, including a holding tank and mixer to allow for makeup of solution using dry ferric sulphate.

Each reactor tank includes a pH sensor to provide continuous monitoring of pH.

Each reactor tank is equipped with four air diffusers which supply air to the process and provide continuous mixing so that solids are kept suspended. Each train is supplied air by a dedicated blower.

### 2.2.3 *Step 2 – Hydroxide Precipitation and pH Adjustment*

Water flows by gravity from TA-110 and TA-210 to TA-120 and TA-220 respectively. Here, hydrated lime is injected into the process to increase pH and aid in further precipitation of some metals through hydroxide precipitation.

Hydrated lime solution is made manually by adding dry hydrated lime and raw influent water to a mixing tank (TA-020). A mixer is run continuously to ensure the hydrated lime slurry does not solidify.

One hydrated lime chemical pump is utilized to dose each reactor tank with chemical. Two motorized valves (MV-120 and MV-220) are used to control the flow of lime to each reactor tank. Each reactor tank includes a pH sensor to provide continuous monitoring of pH.

Each reactor tank is equipped with four air diffusers which supply air to the process and provide continuous mixing so that solids are kept suspended. Each train is supplied air by a dedicated blower.

### 2.2.4 *Step 3 – Flocculation*

Water flows by gravity from TA-120 and TA-220 to TA-130 and TA-230 respectively. Here, polymer is injected into the process to aid in flocculation of suspended solids prior to filtration.
Polymer solution is made manually by adding dry polymer and raw influent water to a mixing tank (TA-030). A mixer is run continuously to ensure uniformity of the polymer solution.

Two polymer chemical pumps are utilized to provide polymer dosing to each train. Polymer can be dosed directly into each reactor tank, or inline through a static mixer located directly downstream of the reactor tank.

### 2.2.5 *Step 4 – Filtration*

Water from TA-130 and TA-230 is pumped to a geotube pond via two diesel powered centrifugal trash pumps (PU-200A/B).

Water is directed to a manifold where it can be distributed to two geotube bags for solids filtration. Two additional geotube bags can be deployed in the pond once the currently operating geotube bags have reached capacity. These spare geotubes are currently stored in a warehouse for future use.

Filtered water leaves the geotube bags and is directed to a collection point at the North West corner of the pond. From here, water is pumped via one diesel trash pump (PU-300) to the Mary River discharge point, or recycled back to the inlet pond. A flow meter is installed on the discharge line to Mary River to allow for data logging of flow.

## 2.3 Major Equipment List

The WTP layout is provided in appendix A. A list of major equipment is provided in Table 2.

**Table 2: Major WTP Equipment**

| Equipment | Description | Qty | Drawing Reference (If Available) |
|---|---|---|---|
| Pond Transfer Pump | Model: Prime Aire PA4A60-404ST<br>Power: Diesel Driven<br>Capacity: 140m3/hr | 2 | PU-100 A / PU-100 B |
| Inlet Flow Meter | Model: GF Signet 3-2551-P1-42 | 2 | FT-100 / FT-200 |
| Ferric Reaction Tank | Material: Polyurethane<br>Size: 5.9m W x 1.5 H<br>Capacity: 24,820 Liters | 2 | TA-110 / TA-210 |
| Lime Reaction Tank | Material: Polyurethane<br>Size: 5.9m W x 1.5 H<br>Capacity: 24,820 Liters | 2 | TA-120 / TA-220 |
| Polymer Reaction Tank | Material: Polyurethane<br>Size: 5.9m W x 1.5 H<br>Capacity: 24,820 Liters | 2 | TA-130 / TA-230 |
| Aeration Blowers | Gast R7100A-3 Blower<br>• 208 V / 3 HP / 60 Hz | 2 | BL-100A / BL-100B |
| pH Controller and Sensors | Model: Walchem W900 (Controller)<br>Model: Walchem WEL-PHF-NN (Sensors) | 1 | pH-110/120/210/220 |
| Motorized Ball Valve | Hayward 1” Ball Valve<br>Model: HRSN2 | 2 | MV-120 and MV-220 |
| Level Transmitter | Model: Echosonic 11 LU27 | 2 | LT-130 / LT-230 |
| Bag Filter | Model: FTI830-2P-150-CS-BS-P13-DP<br>Bag Size: 5 Micron | 1 | FIL-100 |
| Ferric Chemical Pump | Model: Walchem EHE31E1-VC<br>Power: 115 VAC/1hp/60Hz<br>Capacity: 1 LPM @ 105m TDH | 2 | PU-010A / PU-010B |
| Lime Chemical Pump | Model: Flowmotion FR25-HR30HR<br>Power: 230V/3hp/60Hz<br>Capacity: 9.5 LPM @ 105 m TDH | 1 | PU-020 |
| Polymer Chemical Pump | Model: Flowmotion FR25-HR30HR<br>Power: 230V/3hp/60Hz<br>Capacity: 16.5 LPM @ 105 m TDH | 2 | PU-030A / PU-030B |
| Ferric Mixing Tank | Material: Polyurethane<br>Size: Ø 1.2m x 1.3m Height | 1 | TA-010 |
| Lime Mixing Tank | Material: Polyurethane<br>Size: Ø 1.8m x 1.7m Height | 1 | TA-020 |
| Polymer Mixing Tank | Material: Polyurethane<br>Size: Ø 1.6m x 1.6m Height | 1 | TA-030 |
| Coarse Bubble Diffusers | Model: Maxair 24” SS | 24 | - |

## 2.4 System Automation

The system is automated through a main control panel located in the system enclosure. The system P&ID is provided in Appendix A. Operation is outlined in Table 3.

**Table 3: Control Panel Automation**

| Equipment ID | Equipment Description | Control Logic | PID Control Reference | Controls | Panel Indication |
|---|---|---|---|---|---|
| PU – 100 A/B | Inlet Pond Pump | Units can be controlled in Hand or in Auto.<br><br>Pump will turn on in Hand in Auto or in Hand. | - | - | Pump icon will indicate run status |
| | | Pump will turn off if high level is measured in TA-110 or TA-210 | LSH-110 / LSH-210 | Auto | High level alarm at panel |
| | | Pump will turn off if high level measured in TA-130 or TA-230 | LIT-130 / LIT-230 | Auto - High level settable at panel | High level alarm at panel |
| BL-100 A/B | Blower | Units can be controlled in Hand or in Auto<br><br>Blower will turn on in Auto or in Hand | - | - | Blower icon will indicate run status |
| | | BL-100 A will turn off if low level is measured by LIT-130 | LIT-130 | Auto – Low level settable at panel | Low level alarm |
| | | BL-100 B will turn off if low level is measured by LIT-230 | LIT-230 | Auto – Low level settable at panel | Low level alarm |
| pH-110 | pH Sensor | Continuous monitoring of pH | - | - | Display pH on PLC |
| pH-210 | pH Sensor | Continuous monitoring of pH | - | - | Display pH on PLC |

| | | | | | |
|---|---|---|---|---|---|
| pH-210 | pH Sensor | If pH>9.5, close MV-120 - Alarm | MV-120 | Auto – pH set point settable at panel | Display pH on PLC |
| pH-220 | pH Dosage | If pH>9, close MV-220 - Alarm | MV-220 | Auto – pH set point settable at panel | Display pH on PLC |
| PU-010A | Ferric Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If FIT-100 measures flow, PU-010A energizes. | FIT-100 | Auto | Display run status on PLC |
| PU-010B | Ferric Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If FIT-200 measures flow, PU-010B energizes. | FIT-100 | Auto | Display run status on PLC |
| PU-020 | Lime Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | **Speed Control (1 train only)** If pH-120> 8.5, PU-020 will reduce speed. If pH < 8, pump will increase pump speed. If pH is between 8 to 8.5, pump will maintain pump speed. | pH-110 / pH-120 | Auto – pH set point adjustable at panel | Display run status on PLC |
| | | **Speed Control Disabled** If flow is detected by both trains, speed control is disabled. | FIT-100 / FIT-200 | Auto | Display run status on PLC |
| PU-030 A | Polymer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |

| | | | | | |
|---|---|---|---|---|---|
| | | Polymer pump energizes if PU-200 A is on | PU-200A | - | Display run status on PLC |
| PU-030 B | Polymer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | Polymer pump energizes if PU-200 B is on | PU-200B | - | Display run status on PLC |
| PU-200 A | Transfer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If LT-130 measures < 3', PU-200A off. If LT-130 measures >3', PU-200A on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| | | If LT-130 measures >4.5', PU-200A off. If LT-130<4.5', PU-200A on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| PU-200 B | Transfer Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | If LT-230 measures < 3', PU-200B off. If LT-230 measures >3', PU-200B on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| | | If LT-230 measures >4.5', PU-200B off. If LT-230<4.5', PU-200B on. | LT-130 | Auto – Set points adjustable at panel | Pump icon will indicate run status |
| PU-300 | Discharge Pump | Units can be controlled in Hand or in Auto | - | - | Pump icon will indicate run status |
| | | Pump off at LSL-200 | LSL-200 | - | Level indicator on panel |

| | | | | | |
|---|---|---|---|---|---|
| | | Pump on at LSH-200 | LSH-200 | - | Level indicator on panel |
| | | High Level Alarm at LSHH-200 | LSHH-200 | - | High Level Alarm |
| MX-010 /020/030 | Mixer | Units can be controlled on/off manually | - | - | - |

# 3.0 GENERAL STARTUP PROCEDURE

## 3.1 After Dormancy Pre-start-up Procedures

The following steps shall be taken after extended periods of dormancy, prior to general startup of the WTP.

| Task | Check |
|---|---|
| Perform a visual inspection of the system enclosure for signs of water/snow ingress. | ☐ |
| Inspect hose and pipe for signs of leaks, abrasion, or other physical damage. | ☐ |
| Inspect Reactor tanks as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Tank connections for signs of strain or stress.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Blowers as follows:<br>• Signs of abrasion, or other physical damage on all external accessories such as relief valves, gauges and filters.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Diesel Pumps as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Check for and tighten loose attaching hardware.<br>• Make sure that valves at the inlet and outlet are opened.<br>• Check oil levels and lubricate as necessary. | ☐ |
| Inspect Ferric Sulphate pump as follows<br>• Signs of leaks, abrasion, or other physical damage.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Hydrated Lime pumps as follows<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect condition of internal pump hose.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Polymer pump as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect condition of internal pump hose.<br>• Make sure that valves at the inlet and outlet are opened. | ☐ |
| Inspect Level Transmitter as follows:<br>• Monitor debris and ensure the sensor is level and mounted perpendicular to water level.<br>• Check and roughly compare measurement on the PLC with the real on the field. | ☐ |
| Inspect pH sensors as follows:<br>• Monitor debris and deposition of scaling on the transmitter. Perform a cleaning of the sensors as necessary. | ☐ |

-

| | |
|---|---|
| Insect Bag Filter vessel as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect filter bag and replace as necessary | ☐ |
| Inspect Inlet Flow Meter as follows:<br>• Signs of leaks, abrasion, or other physical damage.<br>• Inspect flow sensor for scaling. Clean as necessary. | ☐ |
| Inspect Geotube Bag as follows:<br>• Ensure inlet connection points are securely attached.<br>• Ensure height of bag does not exceed recommended limits. If so, decommission geotube bag.<br>• Clean geotube surface of sediment and scaling to prevent fouling using a push broom, or gentle pressure washing. | ☐ |

## 3.2 Commissioning

After pre-start-up procedures are completed, the system can be energized. The following procedure reflects a high level overview of equipment checks to be performed. Detailed instructions can be found in the product specific manuals. Before any mechanical intervention, disconnect the electrical supply.

### 3.2.1 *Hydrated Lime Pump / Polymer Pump*

| Task | Check |
|---|---|
| Ensure that all protections (cover, cover window, ventilator hood, coupling protection) are in place before operating the pump. | ☐ |
| Check the direction of rotation of the pump. | ☐ |
| Make sure that valves at the inlet and outlet are opened. | ☐ |
| Start the pump by checking its direction of rotation through the cover window. | ☐ |
| Check the flow and discharge pressure and adjust rollers if these figures don't match the pump specifications. | ☐ |

**IMPORTANT:** Ensure lime pump valves remains open during operation. Should valves be left in the closed position, the process line can over pressurize, leading to a rupture of the chemical hose.

### 3.2.2 *Blowers*

| Task | Check |
|---|---|
| Ensure impeller rotation is correct. | ☐ |
| Check filters and inspect for signs of fouling. Replace if necessary. | ☐ |

-

| | |
|---|---|
| Ambient temperature – Check room and discharge air temperatures. Exhaust air should not exceed 135ºC. | ☐ |
| Working pressure and vacuum values – Adjust relief valve pressure or vacuum setting, if needed. | ☐ |
| Motor current – Check that the supply current matches recommended current rating on product nameplate. | ☐ |
| Electrical overload cutout – Check that the current matches the rating on product nameplate. | ☐ |

### 3.2.3 *Ferric Pump*

| Task | Check |
|---|---|
| Ensure pump is energized. | ☐ |
| Make sure that valves at the inlet and outlet are opened. | ☐ |
| Start the pump manually, in order to prime and adjust dosing rates. | ☐ |
| Prime the pump. See manual for details. | ☐ |
| Adjust dosing according to inlet water flow rate. See below. | ☐ |
| Check dosing rate with calibration cylinder. | ☐ |

### 3.2.4 *Motorized Valve*

| Task | Check |
|---|---|
| Ensure valve is energized. | ☐ |
| Ensure valve opens/closes reliably in manual mode: | ☐ |

### 3.2.5 *Diesel Pumps*

| Task | Check |
|---|---|
| Check fuel level and oil levels in the engine, air compressor, pump bearings and seal housing. | ☐ |
| Consult engine operations manual before attempting to start the unit. | ☐ |
| Allow pump to prime. | ☐ |
| Adjust engine speed to desired output. | ☐ |

### 3.2.6 *pH Sensors*

| Task | Check |
|---|---|
| Ensure sensor is calibrated. | ☐ |
| Ensure the pH reading displayed locally at the Walchem panel is transmitted correctly to PLC. | ☐ |

### 3.2.7 *Geotube*

| Task | Check |
|---|---|
| Ensure surface is clean of sediment and debris. | ☐ |
| Ensure all inlet valve are open. | ☐ |
| Ensure height of geotube does not exceed manufacturer recommended limit. | ☐ |

# 4.0 OPERATION

## 4.1 General Operating Instructions

Operation of the WTP will consist of ensuring major equipment (blowers, dosing pumps, motorized valves, level transmitters) is running correctly, and ensuring influent/effluent monitoring and sampling are conducted on schedule.

The drivers for pH adjustment and TSS treatment are operation of the Ferric Sulfate, Hydrated Lime and Polymer Pump, along with the proper performance of the aeration blowers and diffusers equipment.

The unit will run manually. During short term dormancy, the unit can be operated in a “Sleep Mode” where the system is run in a re-cycle status using two submersible pumps inside TA-130 and TA-230 to recirculate water from the end of each train to the beginning of each train. Chemical injection is disabled during dormancy, however, the lime mixer should remain on to maintain suspension of the hydrated lime slurry. Blowers will also remain on to ensure suspension of solids within the reactor tanks.

Parameters to be measured and recorded daily include temperature, pH (typical values are between 6.5 and 9), and TSS. The system must be monitored regularly to ensure pH does not drop below the low level set point or raise above the level set point.

The pH reading should be recorded daily. The pH should be cross referenced regularly with a hand held device. Should the pH differ from the hand held reading, the operator should clean the pH electrodes using a 2-5% solution of hydrochloric acid.

System data can be recorded in the spreadsheet provided in Appendix B. Regular daily monitoring of parameters such as pH, temperature, TSS, and Geotube height must be recorded to ensure proper operation.

## 4.2 Operating Procedure

The following section will outline the step-by-step procedures for operating the treatment system.

### 4.2.1 *Standard Operation*

**Inlet**

The inlet pond level should be checked and recorded prior to start up. Two pond pumps can be utilized to transfer raw water to the treatment system. Usage will depend on the volume of treatment required. At low pond levels, one pond pump and one process train can be utilized. At high levels, both pumps can be utilized to increase the treatment volume.

All pump discharge valves must be opened. The pumps (PU-100 A/B) shall be placed in “Hand” at the PLC. This will energize the pumps and begin transfer of water to the treatment system. The pumps will only turn on if a high level is measured by LSH-110/210 or LT-130/230.

Operators must ensure the inlet pond level is monitored, as the pumps do not include a low level shut off.

**Ferric Pumps (PU-010 A/B)**

Water is transferred from the inlet pond to two reactor tanks (TA-110 and TA-210) where ferric sulphate is injected. The dosage rate of the ferric pumps is determined by the inlet quality of the raw water and can range from 0 to 20 mg/l. The dosage rate is to be determined by the operator.

The dosage rate must be set manually at the pump. Once set, the pump can be set to “Auto” at the control panel. The ferric pumps, PU-010 A and PU-010 B, will energize when flow is detected by FIT-100 and FIT-200 respectively.

Before starting the pumps, all discharge valves must be opened.

**Lime Pump (PU-020)**

After coagulant addition, water flows by gravity to TA-120 and TA-220 where hydrated lime is injected into the process. The dosage rate of the Lime pump is determined by the inlet quality of raw water and the pH required, and can range from 0 to 300 mg/l. The dosage rate is to be determined by the operator.

In manual mode, the speed of the pump can be set at the pump VFD, located on the lime pump stand.

Pump speed will be dependent on the pH measured by pH-120, and the pH set point entered into the panel (adjustable by an operator). At a setpoint of 8.5, the pump will increase speed if pH-120 measures a pH below 8. If pH-120 measures a pH above 9, pump speed will decrease. If pH is measured between 8 to 8.5, the dosage rate will remain the same.

-

At a pH above 9.5, MV-120 and MV-220 will close.

The lime pump will operate continuously, with chemical consistently recirculated to the lime mixing tank (TA-020). This is done to ensure the lime slurry does not settle and solidify in the piping system. At the end of every shift, clean water must be flushed through the piping in order to prevent fouling. Flushing may be required more frequently depending on operational conditions.

Due to the possibility of fouling, the lime pump system must be monitored for pressure consistently.

**Lime Solution Make Up**

Hydrated lime solution is made manually, with the solution concentration ranging from 5-10% depending on volume of raw water to be treated. A concentration of 5% is recommended to minimize line fouling caused by the lime slurry. Higher concentrations can be made, but more frequent line flushing will be required.

The lime tank mixer is operated from the panel, and should be operated continuously to prevent the slurry from solidifying.

**Polymer Pumps (PU-030 A/B)**

The dosage rate of the ferric pumps is determined by the inlet quality and can range from 0 to 3 mg/l.

The dosage rate must be set manually at the pump. Once set, the pump can be set to “Auto” at the control panel. The polymer pumps, PU-020 A and PU-020 B, will energize when the transfer pumps, PU-200 A and PU-200 B are energized.

Before starting the pumps, all discharge valves must be opened.

**Polymer Solution Make Up**

Polymer solution is made manually, with concentration ranging from 0.1 to 0.25% depending on volume to be treated.

The polymer tank mixer is operated from the panel, and should be kept on at all times to maintain uniformity of the solution.

**Blowers**

The blowers are operated from the panel, and should be energized at all times when raw water is being processed in the reactor tanks.

Both blowers (BL-100A and BL-100B) can be set in “Auto” at the panel, at which point they will run continuously until the water level in TA-130 and TA-230 is measured to be less than 6”. This level is settable at the panel.

**Raw Water Bag Filter**

The bag filter provides filtration of water required for chemical makeup. The filter bags should be replaced periodically when differential pressure across the filter exceeds approximately 20 psi.

**Geotube Bags**

Water is transferred from the final reactor tanks (TA-130 and TA-230) by diesel generated trash pumps (PU-200 A and PU-200 B) to the geotube pond. The transfer pumps, PU-200A and PU-200B are operated based on the level measured by the reactor tank level transmitters, LT-130 and LT-230 respectively. These set points are adjustable at the panel.

The height of the geotube bags must be monitored regularly.

## 4.3 Daily Operator Checklist

The following steps outline day-to-day operational procedures for the WTS.

Standard Operation

| Task | Check |
|---|---|
| Check inlet pond and record water level | ☐ |
| Check lime and polymer solutions, make up additional solution as required. | ☐ |
| Place PU-100 A (and PU-100 B if necessary) in Hand mode at the control panel. | ☐ |
| Set Ferric Sulphate pump (PU-010 A / B) dose rate and place pump in Auto at control panel. Ensure pump energizes when flow is detected by FIT-100 or FIT-200. | ☐ |
| Turn on hydrated lime pump (PU-020 A) manually. Adjust dose rate based on flow measured by inlet flow meters. | ☐ |
| Monitor hydrated lime pump pressure gauge. If pressure gauge is showing a pressure greater than 15 psi, flush line with water. | ☐ |
| Set polymer pump dose rate at panel. Set in “remote” mode. Set pump to auto at panel. Pump will turn on when PU-200A/B energize. | ☐ |
| Set Blowers (BL-100 A / BL-100B) to Hand. | ☐ |
| Once onion tanks are full, set PU-200A/B to Auto (if using both trains). Ensure downstream valves to geotube bags are open. | ☐ |

| | |
|---|---|
| Observe reactor tank water levels to ensure inlet and outlet flows are balanced. | ☐ |
| Observe and record height of geotube bags. Height must not exceed 6 feet. | ☐ |
| Set PU-300 to auto in the panel. Once the water in the pond reaches the operating float switch, the pump will be energized. | ☐ |
| Discharge vales must be set manually to allow for discharge to the creek, or recycle back to the inlet pond. Set valves in correct position. | ☐ |

**Daily Shutdown**

| **Task** | **Check** |
|---|---|
| Set inlet pump to Off position | |
| Allow reactor tanks to be pumped down to ¼ volume. | ☐ |
| Turn off chemical pumps. | ☐ |
| Flush lime line with water | ☐ |
| Keep lime mixer (Mix-020) on to ensure hydrated lime slurry remains in liquid form. | ☐ |
| If tanks are lowered, blowers can be turned off. If tanks are kept full, energize recirculation pumps. | ☐ |
| Check lime and polymer solutions, make up additional solution if required. | ☐ |
| Turn transfer pumps (PU-200 A/B) and discharge diesel pump (PU-300) off. | ☐ |

# APPENDIX A –DRAWINGS




NOTES:

PU-200A/B- Transfer Pump
PU-300- Discharge Pump
FT-300- Flow Meter
LS- Level Switch
-LSHH 200
-LSH 200
-LSL 200

Process lines
Instrumentation lines

Process based on conceptual desgin by Golder Associates

REVISION TABLE

| No. | DESCRIPTION | DATE |
|---|---|---|
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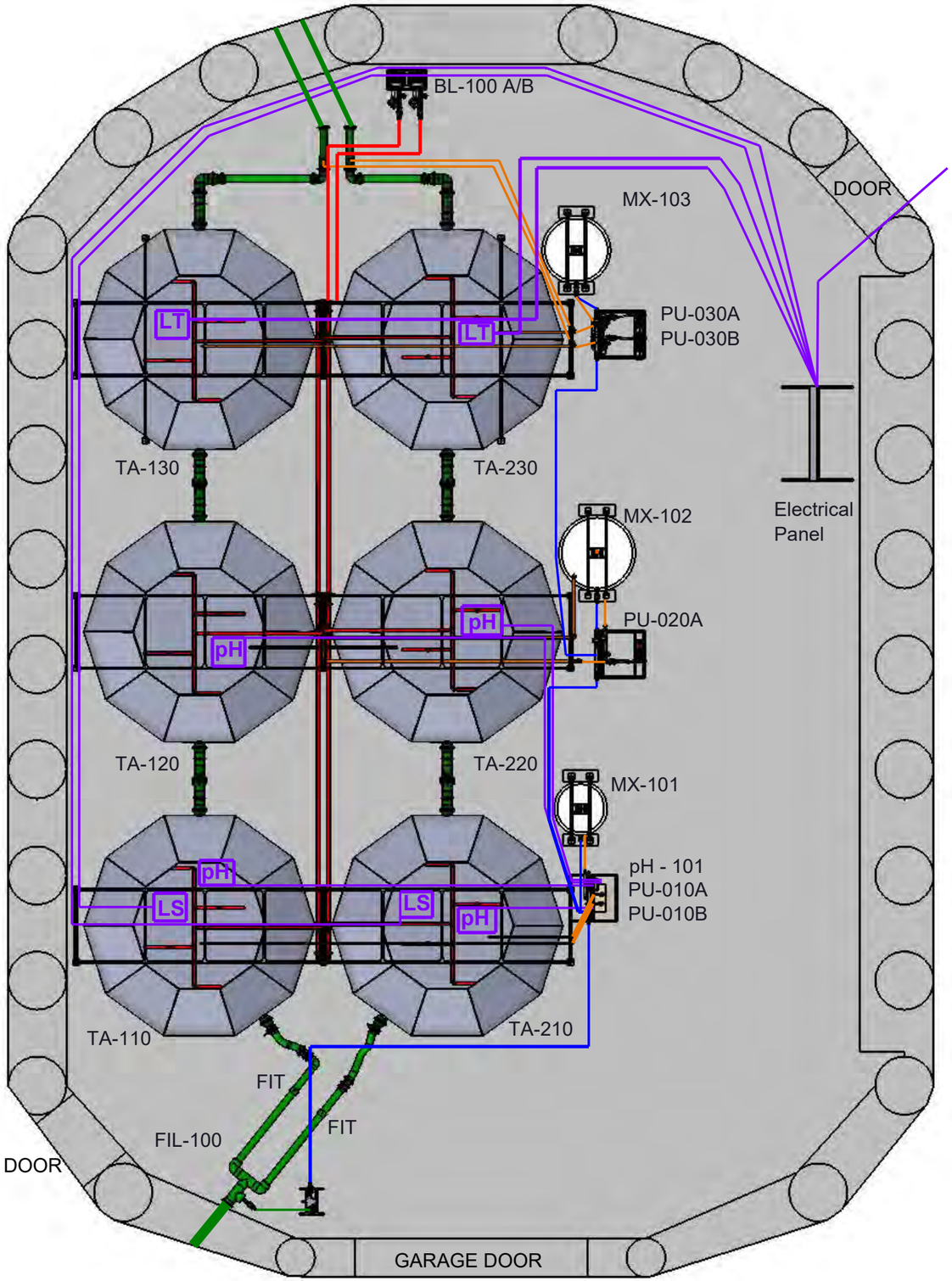
McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

**FULL SITE LAYOUT**
**GENERAL ARRANGEMENT DRAWING**
**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: L.S | FIG: GA-001 |




**LEGEND**

BL-100 A/B - Blower
FIL-100 - Bag Filter
MX-101 - Ferric Mixing Station
MX-102 - Lime Mixing Station
MX-103 - Polymer Mixing Station
PU-010 A/B - Ferric Pump
PU-020 - Lime Pump
PU-030 A/B - Polymer Pump
TA-110 - Ferric Process Tank (Train 1)
TA-210 - Ferric Process Tank (Train 2)
TA-120 - Lime Process Tank (Train 1)
TA-220 - Lime Process Tank (Train 2)
TA-130 - Polymer Process Tank (Train 1)
TA-230 - Polymer Process Tank (Train 2)
pH-101 - pH Controller
FIT - Flow Meter
pH - pH Sensor
LS - Level Switch
LT - Level Transmiter

**Notes:**

- Process Lines
- Water Make-up Lines
- Chemical Lines
- Air Lines
- Instrumentation Line

**Process based on conceptual design by Golder Associates**

REVISION TABLE

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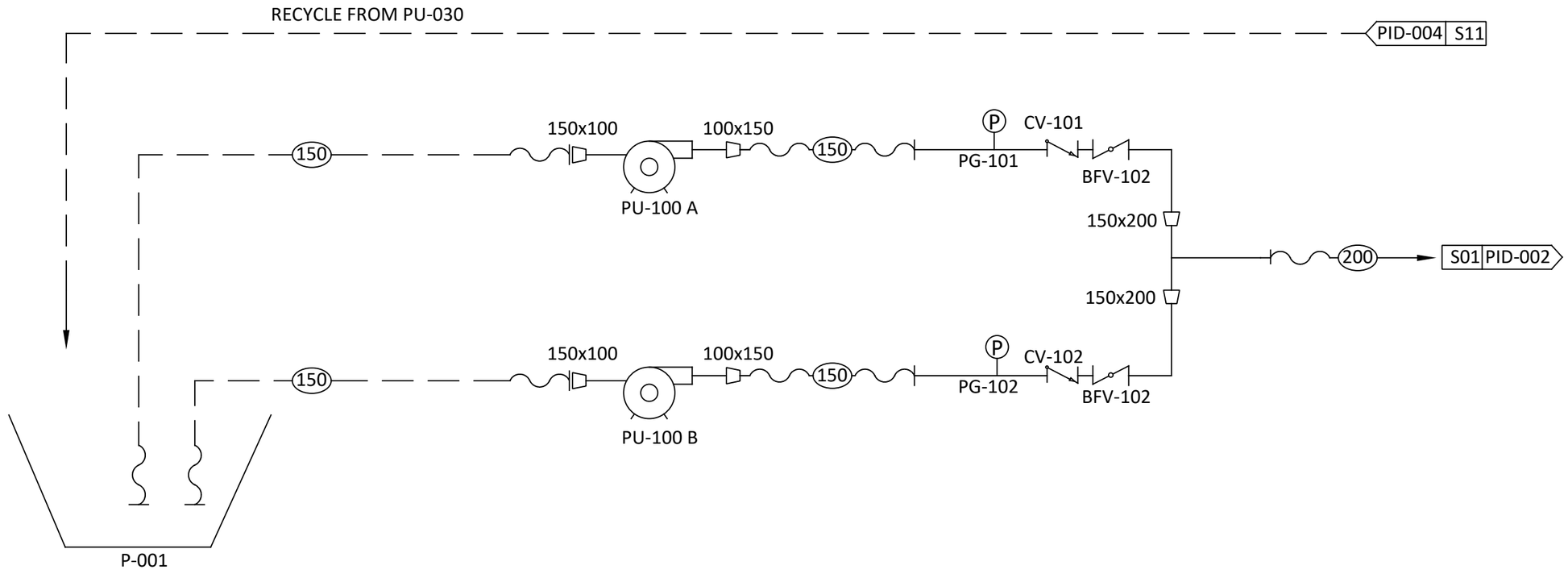
McCUE ENGINEERING CONTRATORS

CLIENT:

BAFFINLAND IRON MINES CORPORATION

**BUILDING LAYOUT**
**GENERAL ARRANGEMENT DRAWING**
Waste Rock Pile Water Treatment Plant

| | |
|---|---|
| DATE: August 17, 2018 | SCALE: AS SHOWN |
| DATA BY: R.B | JOB NO: 137-0001 |
| DRAWN BY: L.S | FIG: GA-002 |




P-001
Inlet Storage Pond

PU-100 A/B
Pond Transfer Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 140m³/hr

**LEGEND :**

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
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| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
| | | |

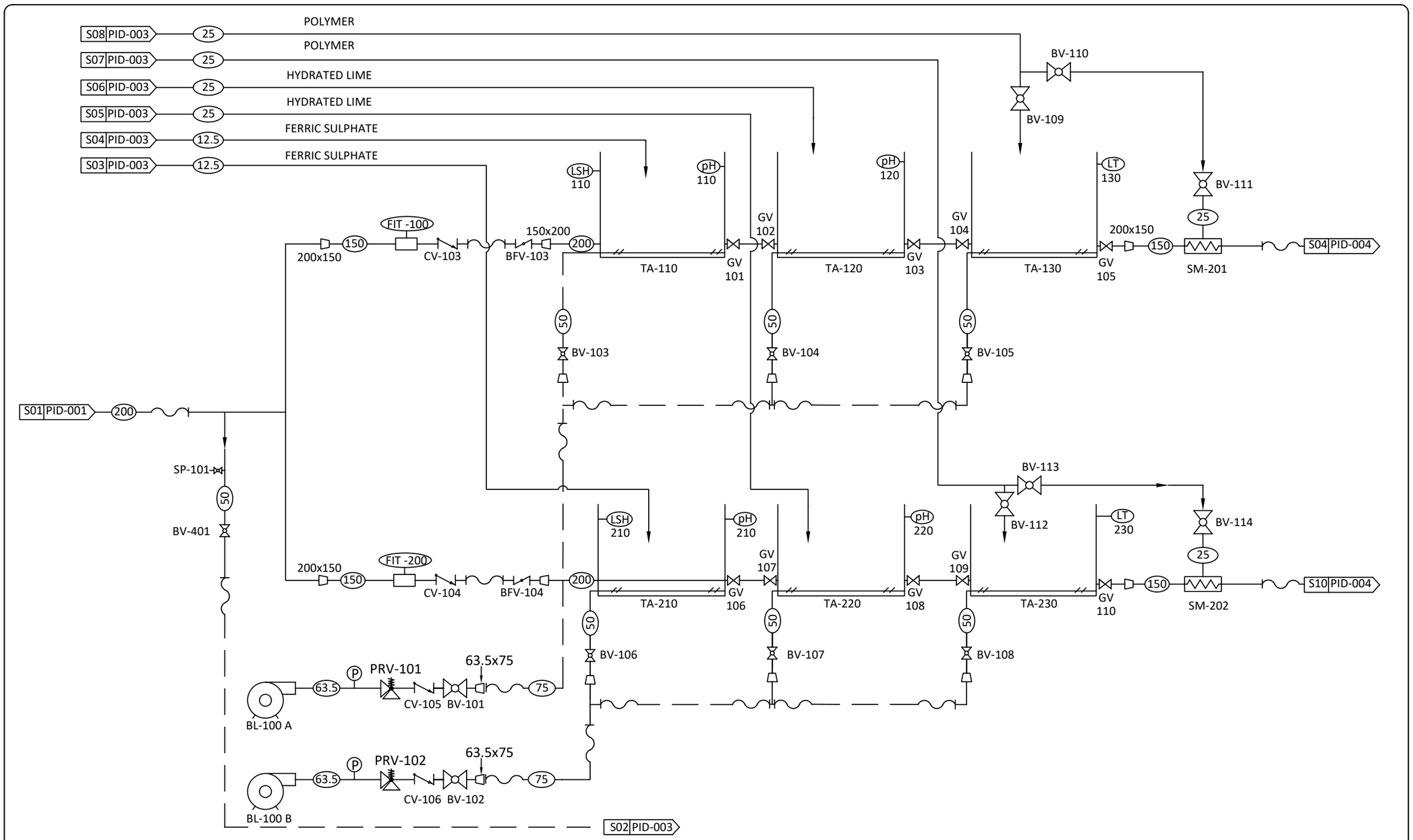
McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

**Waste Rock Water Storage Pond**
**PROCESS & INSTRUMENTATION DIAGRAM**
**Waste Rock Pile Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-0001 |




**BL-100 A/B**
Blower
Model: Gast R7100A-3
Power: 208V/3hp/60Hz
Capacity: 500m³/hr @ 1.9m TDH

**TA-110/210**
Ferric Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

**TA-120/220**
Lime Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

**TA-130/230**
Polymer Reaction Tank
Material: Polyurethane
Size: 5.9m W x 1.5 H
Capacity: 24,820 Liters

**FT-100/200**
Influent Flow Meter
Model: GF Signet 3-2551-P1-41

**LT-130/230**
Level Transmitter
Model: Echosonic 11 LU27

**pH-110/120/210/220**
pH Meter
Model: Walchem WEL-PHF-NN

**LEGEND:**

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge
- Static Mixer
- Gate Valve
- Pressure Relief Valve
- Ball Valve
- Sample Port
- Flow Meter
- Level Switch
- pH Sensor
- Level Transmitter

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
| 0 | Original Issue | April 30, 2018 |
| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
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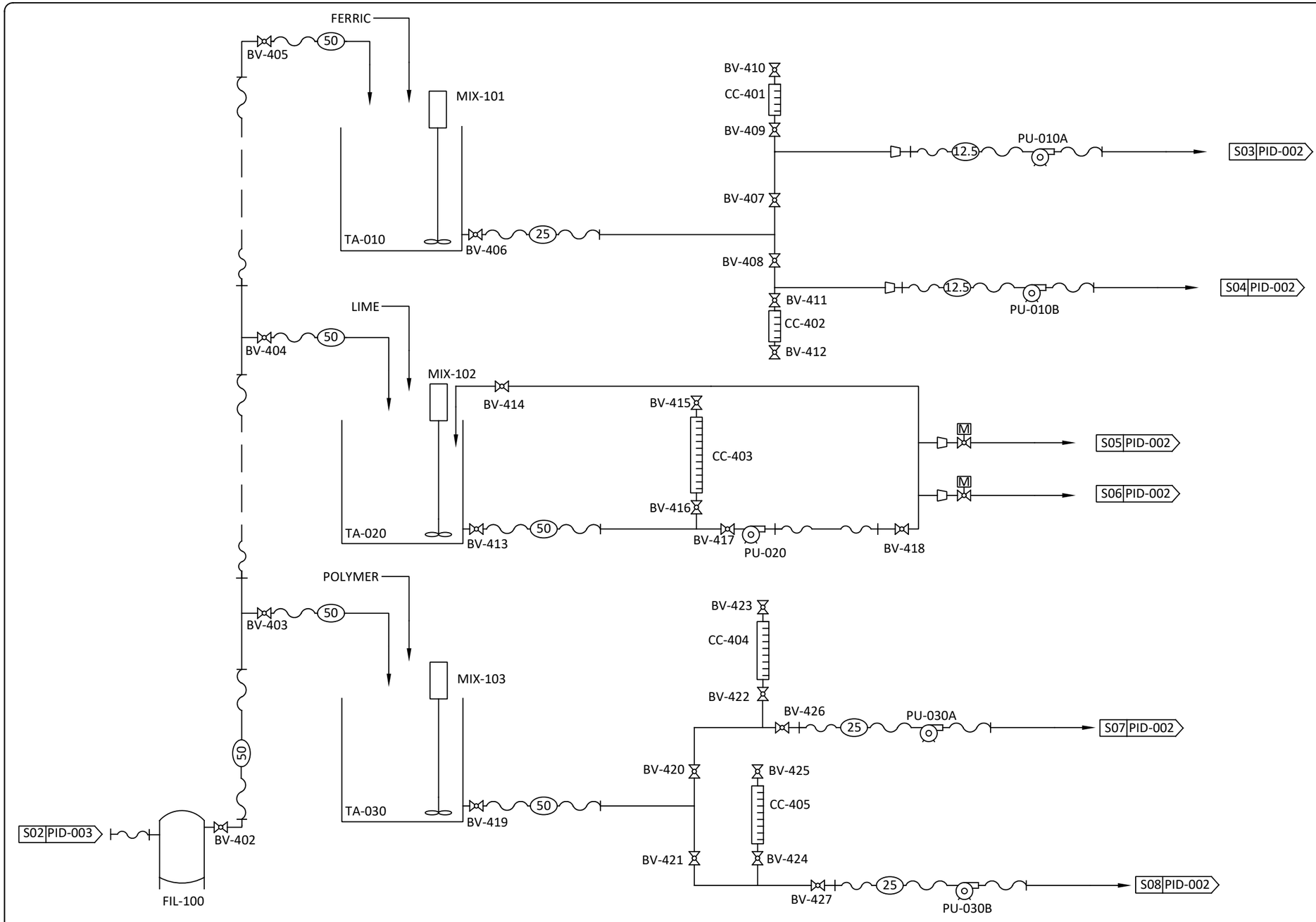
McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

# REACTION TANKS
## PROCESS & INSTRUMENTATION DIAGRAM
**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-0002 |




**LEGEND:**

- Hose
- Sch. 80 PVC Pipe
- Ball Valve
- Reducer
- Motorized Ball Valve

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
| 0 | Original Issue | April 30, 2018 |
| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
| | | |

McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

**CHEMICAL MAKEUP**
**PROCESS & INSTRUMENTATION DIAGRAM**
**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-003 |

FIL-100
Bag Filter
Model: FTI 830-2P-150-CS-BS-P13-DP
Bag Size: 5 Micron

PU-010A/B
Ferric Chemical Pump
Model: Welchmen EHE31E1-VC
Power: 115 VAC/1hp/60Hz
Capacity: 21 LPM @ 106m TDH

PU-020
Lime Chemical Pump
Model: Flowmotion FR25-HR30HR
Power: 230V/3hp/60Hz
Capacity: 570 LPM @ 42m TDH

PU-030
Polymer Chemical Pump
Model: Flowmotion FR25-HR30HR
Power: 230V/3hp/60Hz
Capacity: 990 LPM @ 42m TDH

MIX-101
Ferric Mixer
Model: Dynamix DMX-5505K-1
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 41" Long

MIX-102
Lime Mixer
Model: Dynamix DMX-5505K-2
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 52" Long

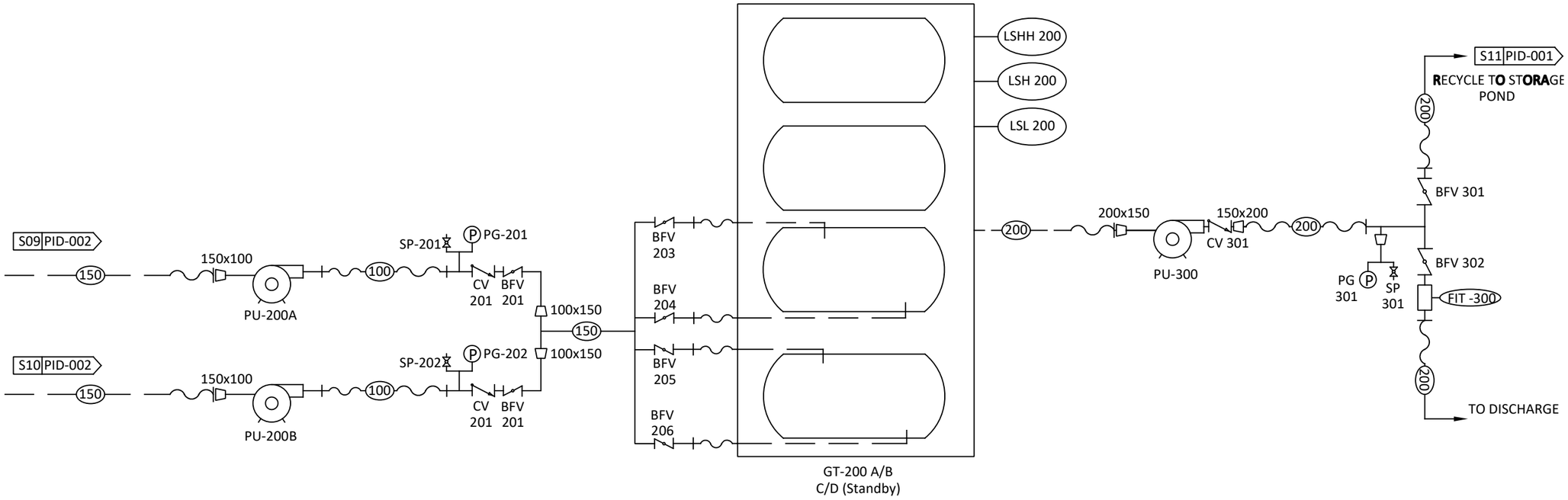
MIX-103
Polymer Mixer
Model: Dynamix DMX-5505K-1
Power: 0.5 HP, 230V/1Ph/60Hz
Shaft: 1" Diameter x 49" Long

TA-010
Ferric Mixing Tank
Material: Polyurethane
Size: Ø 1.2m x 1.3m Height

TA-020
Lime Mixing Tank
Material: Polyurethane
Size: Ø 1.8m x 1.7m Height

TA-030
Polymer Mixing Tank
Material: Polyurethane
Size: Ø 1.6m x 1.6m Height

CC-401/402/403/404/405
Calibration Column




**PU-200A/B**
Transfer Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 140m³/hr

**GT-200 A/B/C/D**
Geotube
Model: Tencare GT500
Dimensions: 60' Circumference x 100' Long

**PU-300**
Discharge Pump
Model: Prime Aire PA4A60-404ST
Power: Diesel Driven
Capacity: 280m³/hr

**FT-300**
Flow Meter
Model: Toshiba GFG32

**LEGEND:**

- Hose
- Sch. 80 PVC Pipe
- Butterfly Valve
- Check Valve
- Reducer
- Pressure Gauge
- Sample Port
- Level Switch

Process based on conceptual design by Golder Associates

| NO. | REVISION TABLE | DATE |
|---|---|---|
| 0 | Original Issue | April 30, 2018 |
| 1 | Record Drawing | July 31, 2018 |
| | | |
| | | |
| | | |

McCUE ENGINEERING CONTRACTORS

CLIENT:

**BAFFINLAND IRON MINES CORPORATION**

# GEOTUBE FIELD PROCESS & INSTRUMENTATION DIAGRAM

**Waste Rock Pile Water Treatment Plant**

| | |
|---|---|
| DATE: July 31, 2018 | SCALE: NTS |
| DATA BY: R.B. | MCCUE JOB NO: 137-0001 |
| DRAWN BY: M.T. | FIG: PID-004 |

# APPENDIX B - MONITORING

McCUE ENGINEERING CONTRACTORS EST. 2000

BROWNFIELDS TO GOLD MINES

Monitoring Spreadsheet

Project Name: BaffinLand Iron Mine
Waste Pile Water Treatment

| Date | Time | OP | Inlet Quality | | | Train 1 | | | | | | Train 2 | | | | | | Discharge | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Temp ºC | Inlet pH | Inlet TSS mg/L | FIT-100 (L/s) | pH-110 | pH-120 | Ferric Dosage Stroke/Speed | Lime Dosage Hz | Polymer Dosage Hz | FIT-200 (L/s) | pH-210 | pH-220 | Ferric Dosage Stroke/Speed | Lime Dosage Hz | Polymer Dosage Hz | FIT-300 (gpm) | FIT-300 Totalizer (gpm) | Geotube Pond pH | Geobag 1 Height (m) | Geobag 2 Height (m) | Discharge pH | Discharge Turbidity NTU | Discharge TSS (mg/L) |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |

# Appendix L – Oily Water Treatment and Discharge Plan

The information contained herein is proprietary Baffinland Iron Mines Corporation and is used solely for the purpose for which it is supplied.
It shall not be disclosed in whole or in part, to any other party, without the express permission in writing by Baffinland Iron Mines Corporation.

Note: This is an UNCONTROLLED COPY. All staff members are responsible to ensure the latest revision is used.

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited
900 Maple Grove Road, Unit 10
Cambridge, ON N3H 4R7
Canada
T: 519-650-7100

# Technical Memo

**To:** Connor Devereaux, Baffinland Iron Mines

**From:** Jack Hinds, P.Eng, Wood E&IS

**Reviewer:** Jered Munro, P.Eng, Wood E&IS

**Project No.:** TPC192071

**Date:** 29 April 2020

**Re:** Oily Water Treatment and Discharge

## 1.0 Background

Baffinland Iron Mines Corporation (Baffinland) has retained Wood Environment and Infrastructure Solutions, a Division of Wood Canada Ltd (Wood E&IS) to prepare this technical memo, outlining treatment, and disposal options for hydrocarbon impacted and oil-contaminated waters contained in the hazardous waste berms (HWBs) at the Milne Inlet and Mary River sites.

The HWBs are typically used to house containers of contaminated material or hazardous waste from around site, and accumulation is comprised mostly of impacted stormwater. However, sump water from the maintenance shops is also periodically added to the HWBs.

In addition to the HWBs, Baffinland also operates a landfarm facility, and a snow dump facility, at the Milne Port Site. These facilities also contain stormwater impacted by their contents, and receive sump water from the maintenance shops. For the purposes of this report, the landfarm and snow dump facilities are referred to as HWBs.

The intent of this memorandum is to outline options that could be employed to treat waters contained in the HWBs, landfarm, and snow dump, to a level that is compliant with the approved Type A Water Licence requirements and be discharged to the environment under those requirements. The proposed treatment options may be used individually or combined with other treatment options to form a treatment system that is capable of achieving compliant effluent quality. This approach has been selected to provide operators with the ability to address various water quality issues that can occur due to changing conditions on site, caused by the various site sources noted above, and the natural environment.

The HWBs can potentially require treatment for:

- Removal of total oil and grease (TOG)
- Removal of benzene, toluene, ethylbenzene, xylene (BTEX)
- Removal of total and dissolved lead
- Removal of total suspended solids (TSS)
- Removal of total ammonia
- Removal of total phosphorus
- Removal of oil and grease
- Destruction of faecal coliforms
- Acute Toxicity associated with inorganic or organic compounds
- Control of pH

'Wood' is a trading name for John Wood Group PLC and its subsidiaries
Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited
Registered office: 2020 Winston Park Drive, Suite 700, Oakville, Ontario L6H 6X7
Registered in Canada No. 773289-9; GST: 899879050 RT0008; DUNS: 25-362-6642

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Canada
T: 519-650-7100

## 1.1 Onsite Water/Wastewater Treatment Equipment

There are a number of onsite water treatment resources at the Project site that are available for use in treating the HWBs. The equipment is owned and maintained by Baffinland, and is typically operated by Baffinland, or is operated under contract with an engineering or operations firm. It is expected that Baffinland may be required to purchase additional equipment and/or upgrade existing equipment.

Baffinland maintains a supply of common treatment chemicals required by the treatment processes. Less common chemicals used for treatment are brought to site on an as-needed basis.

# 2.0 Treatment of HWBs

HWB treatment occurs during the spring and summer discharge seasons, when the water in these structures is not frozen. Water quality in the HWBs can be variable, and often changes over the course of the year. The variations in water quality are typically caused by:

- Contributions to the HWBs
- Spring melt, and ice retained within the HWBs
- Fluctuations in temperature and pH
- Biological activity and consumption of nutrients (if present)
- Diurnal effects, exacerbated by long periods of daylight/twilight during the mid-summer months

The treatment methods represent the processes that may be employed to achieve compliant water quality in the HWBs and allow for discharge to the environment. The options presented have been listed discretely but may be combined to form a treatment train in order to address the specific impacted source water quality. As the water quality can change over the course of a single operating season, multiple treatment methods or approaches may be required in order to maintain compliant effluent quality.

## 2.1 Spring Discharge

During the winter months the HWBs will typically freeze down to the sand-lined bottom of the ponds. During spring freshet, warmer temperatures and increased daylight hours cause the top layer of ice to thaw first, creating a pool of clear water on the surface of the HWBs.

Under some circumstances, this initial melt water may be compliant for discharge due to stratification of various contaminants over the winter months. If the water quality analysis confirms the meltwater is compliant, it may be discharged to the receiving environment without further treatment.

The discharge will be monitored for compliance following the guidelines given in Section 3.0.

## 2.2 Oily Water Treatment Systems

Baffinland owns and operates two Oily Water Treatment System (OWS) for treatment of impacted water from the HWBs. These systems have been designed to be modular, and allow for modification of the treatment process depending on the quality of the source water. These systems are housed inside insulated, ventilated 40 foot-long shipping containers, and at a minimum contain the following:

- Influent submersible pumps
- Oil/Water Separator (American Petroleum Institute design)

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- Forwarding pump
- Bag filter
- Flowmeter and totalizer
- Discharge assembly, including a vacuum breaker and effluent line connection
- Pressure sensing equipment
- Alarms and emergency stops
- Control system and HMI
- Main electrical control panel

Following the forwarding pump, different treatment components can be installed using camlock hoses, to provide various types and levels of treatment. These additional treatment steps will be discussed in the following sections.

## 2.3 Adsorptive Media Treatment

Adsorption media is inert and readily available for transportation and use for treatment for various organics and metal species. The OWS units onsite allow for use of plastic or steel media vessels to be loaded with the required contaminant removing media and connected to the remainder of the system. Multiple types of media may be used in series, to treat various contaminants as required. Typical adsorption medias that are used for treatment include:

- Granular activated carbon (GAC)
- Synthetic ion exchange resins
- Activated alumina
- Activated iron products
- Natural Zeolites
- Reductive media, such as zero-valent iron
- Other adsorptive and ion exchange media as applicable

Adsorption based treatment systems are typically sensitive to solids in the water and may become blocked if solids concentrations are too high. Filtration is typically required prior to an adsorptive media treatment step to prevent fouling.

## 2.4 Bulk Treatment

Bulk treatment of impounded water onsite may be used as a method to provide removal of TSS, BOD, total phosphorus, total ammonia, precipitation of metals, or oxidation of volatile compounds. Treatment of the entire impacted source allows for rapid, bulk treatment of the contents of the HWBs and allows for confirmatory sampling prior to discharge to the environment.

A typical treatment system would require:

- A berm mixing system
- Chemical dosing systems
- Inline mixers, such as a mixing tank, tube flocculator, or static mixer
- Flowmeter for flow measurement and totalization

Bench scale jar testing would be completed using chemistry that is accepted for treatment of the non-compliant water parameters and to estimate the chemical dosing rates required for the complete pond volume. The pond would then be mixed, and chemicals would be added at dosing rates in accordance with the jar test results. Chemical addition may be completed in multiple stages to achieve the required treatment results.

Once dosing is complete, the HWB will continue to be mixed for an appropriate amount of time, to ensure the chemical(s) reacts fully and all contents of the berm have been incorporated. Once mixing is complete, the mixing system will be shut off, to allow any coagulated/flocculated solids to settle, or to allow for natural stripping processes to occur. An effluent discharge system will be set up where required and will allow for recirculation of effluent back into the HWB in the event a non-compliant sample is tested or additional mixing is

required. A complete set of laboratory analysis compliant with the criteria outlined in Section 3.0 will be received and reviewed prior to any discharge.

For bulk treatment, the following chemicals may be used:

- Aluminum sulfate (alum)
- Poly-aluminum chloride (PAC)
- Sodium aluminate
- Alum potash
- Ferric/ferrous sulfate
- Ferric chloride
- Lime/soda ash
- Caustic soda
- Vendor-specific, proprietary anionic or cationic polymers
- Sulfuric acid
- Citric acid
- Hydrochloric acid
- Phosphoric acid
- Nitric acid
- Sodium hydroxide
- Sodium bicarbonate
- Potassium permanganate
- Sodium metabisulfite/sodium bisulfite
- Sodium hypochlorite
- Magnesium hydroxide

### 2.4.1 Settled Solids Handling and Disposal

Solids removed as part of this treatment method will naturally settle into the sand layer at the bottom of the containment facilities but may be stirred up by wind or other surface disturbance. Quantities of settled solids resulting from any treatment processes are considered to be insignificant relative to the volume of the berms. If necessary, Baffinland may elect to drain any of the berms to remove the settled solids and dispose of in the appropriate disposal location (landfarm, backhaul, etc).

## 2.5 pH Adjustment

pH adjustment may be required as a standalone treatment or may be required as part of a larger treatment system in order to maintain compliance. pH adjustment can be carried out within the containment berms or adjusted inline prior to discharge.

A typical pH adjustment system may require:

- A berm mixing system
- Chemical dosing systems
- Temporary chemical storage
- Inline mixers, such as a mixing tank, tube flocculator, or static mixer

pH in the HWBs can be acidic, neutral, or basic, depending on what has been stored in the containment area, and what kind of natural biological activity has occurred. The water quality from other treatment processes may require that pH adjustment be added as part of the treatment process to ensure compliant effluent.

The following chemicals may be used to form part of a pH adjustment system:

- Aluminum sulfate (alum)
- Poly-aluminum chloride (PAC)
- Sodium aluminate
- Alum potash
- Ferric/ferrous sulfate
- Ferric chloride
- Lime/soda ash
- Caustic soda
- Sulfuric acid
- Citric acid

- Hydrochloric acid
- Phosphoric acid
- Nitric acid
- Sodium hydroxide
- Sodium bicarbonate
- Magnesium hydroxide

## 2.6 Filtration

Filtration systems provide a physical barrier, allowing for the removal of solid matter from a liquid stream. Filtration may be used as an effective means of reducing/removing TSS, BOD, total phosphorus, TOG, and precipitated compounds such as metal hydroxides. Filtration may be used as a standalone treatment process or as part of a larger treatment system.

A typical solids filtration system may employ one or more of the following technologies:

- Basket strainers
- Bag filters
- Disposable cartridge filters
- Backwashing cartridge filters
- Sand filters
- Continuous backwash sand filters
- Multimedia filters
- Rotary drum screens
- Belt filters
- Microfiltration
- Ultrafiltration
- Nanofiltration
- Membrane filtration
- Reverse osmosis

Filters used either alone, or in conjunction with other treatment processes, may be stand-alone, skid mounted, packaged, or contained within their own seacan.

### 2.6.1 Filtered Solids Handling

For most cartridge or bag filtration systems, solids are removed through capture on a fiber media, which cannot be backwashed. The media must be removed and disposed of according to Baffinland's Waste Management Plan.

Effluent from the backwashing of filters may be directed into the HWBs, or into dedicated storage vessels for further treatment or disposal offsite.

## 2.7 Transfer of Water Between HWBs

It may be necessary to transfer contaminated water from one HWB to another, or from HWBs at one site, to HWBs at another. This allows for contaminated water at each site to be managed and treated in the most effective way possible.

As the treatment systems for these contaminated waters are typically only established once during a discharge season, contaminated water may also be transferred between HWBs to facilitate treatment. If possible, water may also be brought directly to a treatment system for immediate treatment and discharge.

# 3.0 Sampling and Performance Monitoring

The effluent discharge quality criteria for the HWBs varies based on the discharge location and is defined in the Type A Water Licence 2AM-MRY1325 Amendment No. 1 as issued by the Nunavut Water Board, July 31, 2014. The following tables summarizes the discharge criteria:

Table 1: Effluent Quality Discharge Limits for Oily Water Treatment Facilities

| Parameter | Discharge to Freshwater<br>Max concentration of any grab sample (mg/L) |
|---|---|
| pH | Between 6.0 and 9.5 |

| | |
|---|---|
| TSS | 35 |
| Ammonia | 4.0 |
| Phosphorus | 4.0 |
| Benzene | 0.370 |
| Ethylbenzene | 0.090 |
| Toluene | 0.002 |
| Oil and Grease | 15 and no visible sheen |
| Arsenic | 0.5 |
| Copper | 0.3 |
| Lead | 0.2 |
| Nickel | 0.5 |
| Zinc | 0.5 |

Table 2: Effluent Quality Discharge Limits for the Bulk Fuel Storage Facilities

| Parameter | Discharge to Freshwater<br>Max concentration of any grab sample (mg/L) |
|---|---|
| Benzene | 0.370 |
| Toluene | 0.002 |
| Ethylbenzene | 0.090 |
| Lead | 0.001 |
| Oil and Grease | 15 and no visible sheen |

Table 3: Effluent Quality Discharge Limits for the Landfarm Facilities

| Parameter | Discharge to Freshwater<br>Max concentration of any grab sample (mg/L) |
|---|---|
| pH | Between 6.0 and 9.0 |
| TSS | 15 |
| Oil and Grease | 15 and no visible sheen |
| Total Lead | 0.001 |
| Benzene | 0.370 |
| Toluene | 0.002 |
| Ethylbenzene | 0.090 |

Prior to commencing any treatment or discharge, Baffinland or their contractors will be required to develop and submit a discharge plan including details on monitoring and sampling frequency, safeguards, internal limits, etc.

This plan shall be submitted to the Environmental Superintendent for review and approval prior to any treatment or discharge activities.

Baffinland will complete sampling and confirm compliance prior to discharge to an approved discharge location. During discharge Baffinland will perform field monitoring and testing of representative parameters of concern. The monitoring will be conducted at the intervals specified in the relevant discharge plan and the results of which will be used to guide treatment implementation and the ability to commence or continue discharge to the receiving environment. Discharge samples will be collected in accordance with the schedule laid out in the Type A Water Licence to confirm treated effluent discharge meets the applicable criteria outlined above.

If there are any questions, comments, or concerns regarding the content of this memo, please feel free to reach out to Jack Hinds at 519-650-7143 or Jered Munro at 519-650-7130.

**Wood Environment & Infrastructure Solutions**
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